FEB 6 1930

POPULAR MECHANICS

MA NE

WRITT ND IT

SEE PAGE 386

$2 DOWN

BRAND NEW GENUINE CORONA Model #3

Lowest Price—Easiest Terms Ever Offered

HERE's your chance to own that *brand new* Genuine Model 3 Corona you've wanted—on the easiest terms ever offered—at LOWEST PRICE ever offered. Complete in every detail; back spacer, etc., *Manufacturer's Guarantee.* Recognized the world over as the finest, strongest, sturdiest portable built.

Yours for 10 DAYS FREE

Only a limited number of these splendid machines available. To get one, you must act now! Experience the joy this personal writing portable typewriter can give you! Use it ten days free! See how easy it is to run and the splendidly typed letters it turns out. Ideal for the office desk, home, traveling. Small, compact, light, convenient. Don't send out letters, manuscripts, reports, bills in poor handwriting when you can have this Corona at such a low price on such easy terms. Remember these are *brand new* machines right out of the Corona factory.

Carrying Case FREE

If You Act Now!

Leatheroid carrying case, oiler, instructions free on this offer. Send no money—just the coupon. Without delay or red tape we will send you the Corona. Try it 10 days. If you decide to keep it, send us only $2—then $3 a month until our special price of $39.90 is paid. Now is the time to buy. This offer may never be repeated.

Save Money—Use this Coupon

Smith Typewriter Sales Corp., (Corona Division)
469 E. Ohio St., Chicago, Ill. Dept. 33

Ship me the Corona, F.O.B. Chicago. On arrival I'll deposit $2 with express agent. If I keep the machine, I'll send you $3 a month until the $37.90 balance of $39.90 price is paid; the title to remain with you until then. I am to have 10 days to try the typewriter. If I decide not to keep it, I will repack and return to express agent, who will return my $2. You are to give your standard guarantee.

Name _____

Address _____

Employed by _____

Popular Mechanics Magazine

200 E. Ontario Street, Chicago, U. S. A.

H. H. WINDSOR, Founder — H. H. WINDSOR, Jr., Editor and Publisher

London: Hachette & Cie., 16-17 King William Street, Charing Cross, W. C. 2

Paris: Hachette & Cie., 111 Rue Reaumur

Melbourne: Gordon & Gotch 509-513 Little Collins St.

ISSUED MONTHLY

SUBSCRIPTION:

In United States and its possessions, Canada, Cuba, Mexico, and all countries in the Pan-American Postal Union, per year, postpaid $2.50

To all other countries in the Postal Union 3.00

All subscriptions are discontinued at expiration. Please examine the date printed on your wrapper.

SINGLE COPY, 25 CENTS

Entered as Second Class Matter Sept. 15, 1908, at the Post Office at Chicago, Illinois, under Act of March 3rd, 1879.
Entered as Second Class Matter at the Post Office Department, Canada.

Published monthly by POPULAR MECHANICS CO.

Copyright, 1930, by Popular Mechanics Co. Copyright in Australia. Copyright in France

Vol. 53 — Contents for March, 1930 — No. 3

Special Features

Floating Oil Tanks 370
In the Land of the Devil Dancers 378
Thrills in Search for Sun's Secrets 391
England's Entry in Ocean Race 395
Man-Made Mystery Metals 402
Gold from Butterflies 410
The Strange Adventures of Spies 442
Big Shovels and Why 466

Air Mail—shrinks size of U. S. by more than one-half 423
Airplanes
model, compressed-air motors drive 408
tilted on end to save hangar space 377
Airships—anchors for are one-ton rollers 465
Amusement Devices—"swooper" gives thrills of airplane ride 400
Automobile Accidents—eye, tardiness of, blamed for . . 457
Automobile—Driving—testing skill by revolving map 454
Automobile—supercharger, water-cooled, for front-wheel drive 455
Automobiles
abandoned fill in bay to make an airport 441
fog in front of, lifted by exhaust air 460
Automobiles—Accessories
clock in rear-view mirror 385
frost shield for car window 430
glareless floodlight helps on turns 425
portable compressor operated by engine 465
rubber carpet with hair nap 431
thermostat is easy to fit on any auto 433
Automobiles—Lighting—portable tester adjusts lamps 449
Automobiles—Tires
air-pressure dot on rim shows inflation 450
locking valve keeps pressure constant 416
Automobiles—Truck—store on wheels expands when parked 461
Automobiles—Wheels—axles bent into shape by strength of hand 471
Aviation
aerial survey of the Hudson straits 418
deer hunted from airplanes 449
flying boats cut the time to South America 414
flying fashions combine utility with beauty 426
flying in Eskimo land 418
Bench—made into table by folding back rests 383
Boats and Boating
boat propelled by pedals 369
suction eliminator increases speed 432
Bread—Slicer—cuts 1,000 loaves an hour 400
Buildings—clubhouse like an elevator 369
Church
architecture change shows modern trend 427
floating, in Germany travels waterways 440
Compass—course and distance finders 433
Desk Pad—of composition rubber 441
Divers—test suits in tanks under air pressure 417
Fire Blanket—held on frame 441
Gas—burn coal in ground for 471
Gasoline—filter funnel strains out water 393
Gears—made from cornstalks 383
Gems—blue, colored by heating 465
Gliders—college glider club teaches low-cost flying . . 409
Guns—motorized anti-aircraft for the next war 458
Heating and Ventilating—a cooler for roofs 471
Horses—bucking broncho imitated with saddle and ropes 385
Household Devices 462
House Plan 528
Irrigation—sea water used 377
Lifeboat—for plane rescues 439
Light—speed trap for the earth races light beams . . . 450
Lighting—color organ paints ballroom with magic light 401
Locomotive—has streamline boiler 383
Logs—jam of, for underground 449
Loud Speaker—electric eye works 417
Mammoth—how prehistoric man used the "killer stone"
Maps—city guides on lamp-posts have steel leaves . . 471
Metals
tin gives strength to bronze 425
zinc—base alloys improved 416
Meteors—may menace planes and ships 375
Moving Pictures
portable movie projector has built-in screen 432
talking movies for home 407
Musical Instrument—guitar, keyboard on neck of . . . 454
Oil
from nuts used as fuel 432
steam shovels salvage 382

[Continued on Page 4]

[Contents—Continued]

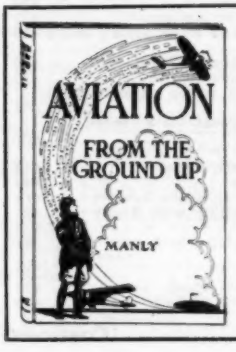
Photography—photograph on metal plate in broad daylight ... 433
Pipe Organ—for the home resembles grand piano ... 375
Plants—gigantic elephant's ear leaf ... 408
Playground
above streets for congested areas ... 447
on hotel roof for golf and tennis ... 448
Post Office—dead letters cost millions annually ... 408
Poultry—five-story chicken hostelry ... 407
Radio
helpful hints from the radio laboratory ... 478
soldering flux, homemade ... 484
ultra-short waves for ... 407
Radio—Aerials—furnace pipe acts as ... 483
Radio—Batteries—connections simplified for charging ... 484
Radio—Construction—kits for set builders ... 480
Radio—Ground—wet, new device provides a ... 483
Radio—Loudspeaker—horn made from cane fibers ... 476
Radio—Loudspeakers—tapestry picture is condenser speaker ... 483
Radio—Receivers
a.c. demonstrating ... 476
remote controls for operation ... 477
ten-feet-high broadcast speeches ... 447
Radio Reception
fewer sunspots to give better ... 384
yardstick to assure better ... 433
Radio—Transformers—a practical homemade power ... 472
Radio—Tubes
checker, combination a.c.-d.c. tubes ... 481
tube-base plug-in coils ... 476
type-45 power, using ... 480
Railroads
compressed-air Diesel engine ... 431
rail joints kept tight by molten-metal spray ... 447
trains with glass which ultraviolet rays penetrate ... 427
Rats—ferret farm breeds animals to exterminate ... 424
Razor, Safety—blade, machine grinds hollow edge on ... 455
Roads—seismograph picks best road ... 374
Rope—anchor of fiber stronger than chains ... 450
Rubber—replaces metal ... 369
Rugs—beauty is woven into rugs from piano-roll patterns ... 376
Sawmill—one-man, for farmer ... 460
Saws and Sawing—automatic saw-handle lock ... 415
Setscrew—tightening ... 512
Ships—liner model steams through crowded harbor ... 393
Shoes—hard-center rubber heel ... 427
Shooting Gallery—sparks in place of bullets ... 414
Sled—toy wagon is made into ... 440
Sling—carrying and lifting for bulky articles ... 416
Sports—Water—scooter propelled by foot-operated oar ... 457
Sports—world's greatest arena ... 451
Straw—fireproof walls of for building material ... 407
Street Lights—service truck has extension platform ... 384
Streets—oil removed with steam and brush ... 447
Submarine—new safety devices ... 428
Swing—whirl-over, for children ... 415
Tanks—test divers' suits under air pressure ... 417
Theater—has four movable stages ... 425
Tide—highest possible is fifty-three feet ... 427
Tray—match, ash and glass holder attach to table ... 416
Typing Machine—prints whole phrases at a time ... 464
Vending Machine—umbrellas of oiled paper sold by ... 460
Watch—garden-of-Eden, two hundred years old ... 457
Water—electric purifier for ... 384
Water Tank—five tanks supported on one tower ... 430
Weather
air is kept warm by arctic ozone ... 369
asking questions of the clouds ... 434
fans aid in daily observations ... 416
Weeds—blue vitriol destroys ... 441
Well—fire and water from one pipe ... 400
Whistle—operated by a switch ... 446
Windows—automatic sash ends need for pulleys ... 375
X-Ray—snapshots are taken with powerful tube ... 375

AMATEUR MECHANICS

Airplanes—scale-model plane is easy to build ... 500
Aquarium—built-in, makes living picture ... 485
Automobiles—improving seating arrangement in two-door sedan ... 499
Automobiles—Accessories—handy map holder ... 497
Automobiles—Repairing—renewing blown cylinder-head gaskets ... 509
Belts—wire solder for repairing ... 487
Bladder—finding leak in basket-ball ... 497
Camera
using narrow film in ... 497
view, carrying case for ... 488
Coffeepot—substitute for glass top ... 507
Collars—simple method of dividing ... 506
Doorbell—eliminating annoyance ... 499
House—visualizing proposed change in ... 508
Hydrant—extension for operating wall ... 506
Icebox—selective lock for ... 509
Ice Creepers—easily made ... 509
Ice Scooter—air propelled model ... 507
Insects—hints on mounting ... 488
Ironing Board—portable saves space ... 510
Jewelry—secret hiding place for ... 510
Kites—sending aerial messages to ... 498
Lantern—gasoline, asbestos curtain for ... 496
Lock-door—made from old strap hinge ... 489
Locks—selective lock for icebox ... 509
Lumber—straightening warped boards ... 499
Needle—easy method of threading ... 489
Oil Gauge—handy wiper for ... 498
Outboard Motor—speed indicator for ... 496
Pump Tank—faucet on ... 489
Silverware—removing dents from ... 509
Skiing—is great sport ... 490
Smokers' Accessories—windshield for the cigar lighter ... 510
Stove, Oil—improving the cookstove ... 497
Tampers—for feet do work of lawn roller ... 496
Telephone—rubber base prevents sliding ... 499
Tongs—fireplace, for handling large logs ... 487

SHOP NOTES

Automobiles—Accessories—shock absorbers for auto seats ... 513
Automobiles—Repairing
removing humps from fenders ... 525
replacing spring on overhead valve ... 521
washers save time in fitting bearings ... 521
Carpets—a carpet-beating short cut ... 521
Coal—chute and pit for unloading from drop-bottom cars ... 512
Drilling—elongated holes ... 525
Heating—blower cuts down fuel cost ... 511
Hog Trough—improved ... 526
Jointer—in the home shop ... 516
Oil Holes—blowing chips out of ... 515
Photography—negative and print drier ... 525
Pipe—trench box speeds up laying ... 513
Plants—wire-screen enclosures protect ... 515
Reamers—holder simplifies grinding shank ... 514
Screws—vise used in driving ... 527
Sketching—paper roll for ... 515
Stairway—homemade disappearing ... 522
Stepladder—crosspiece on protects windows ... 513
Stock Tank—self-filling ... 514
Track—over stairway facilitates moving of shop truck ... 527
Valves—use of emery cloth in reseating ... 515
Workbench—simplifies model airplane building ... 523
Wrench—novel tap ... 514



Complete Course In Aviation

prepares you to take up actual flying practice. Preliminary study doubles the value of instruction time and this practical treatise by Lieut. G. B. Manly, U. S. Army Air Service, Res., covers every phase of the subject in such an easily understood manner as to enable you to become thoroughly posted on aviation.

400 Pages—185 Illustrations
Price $3.50

Will be sent C. O. D. to any address in the U. S.

Popular Mechanics Press
Room P3
200 E. Ontario St., Chicago

Think of it! Genuine UNDERWOOD

Yours for 10 Days FREE

Yes—this world-famous Underwood is yours free for full 10 days. See for yourself the **real bargain** it is. See how beautiful and new it looks—compare its neat, perfect work—without obligation.

Buy Direct at Below ½ Mfr.'s Regular Price

Now Only $1 DOWN

My unchallenged direct sale price and easy terms on this genuine Underwood No. 4 is the lowest ever offered. While they last—less than half (½) the manufacturer's regular price—and easy terms besides. Do not confuse this genuine late model Underwood with inferior or frail machines worth only one-half as much. This is the full sized standard Underwood with 4-row keyboard and late improvements, manufactured to sell regular for $100. **Fully Guaranteed** in writing.

12 REASONS
Why this is the Greatest Value Ever Offered

1. Genuine Underwood
2. Standard 4-row Keyboard
3. 2-color Ribbon
4. Back Spacer
5. Ribbon Reverse
6. Tabulator
7. Automatic Release
8. Shift Lock
9. Lowest Price
10. Easiest Terms
11. 10-Day Free Trial
12. Fully Guaranteed

Easy Terms—Only 10c a Day

Think of it—a genuine late model Underwood reduced to $39.90 (Cash). A saving of over $60 by acting now. Send only $1. deposit for a 10-day Free Trial. Then only 10c a day on my easy year-to-pay plan. And you use and enjoy your typewriter all the time. Remember this Underwood all rebuilt and refinished like new is without question the greatest value ever offered at this rock-bottom price. (See column to left for its many outstanding features and improvements.)

INTERNATIONAL TYPEWRITER EXCHANGE
Dept. 394
231 W. Monroe Street, Chicago

FREE—Complete 9-Piece Office Supply Set and Touch Typewriting Course

We teach you speed typewriting Free. Complete Home Study Course of the Famous Van Sant Speed Typewriting System, fully illustrated, easily learned. We also give complete office supply set free during this sensational sale.

Send at Once!

This exceptional bargain offer is for a very limited time only. Remember, every typewriter is sent on 10-days' Free Trial and Fully Guaranteed.

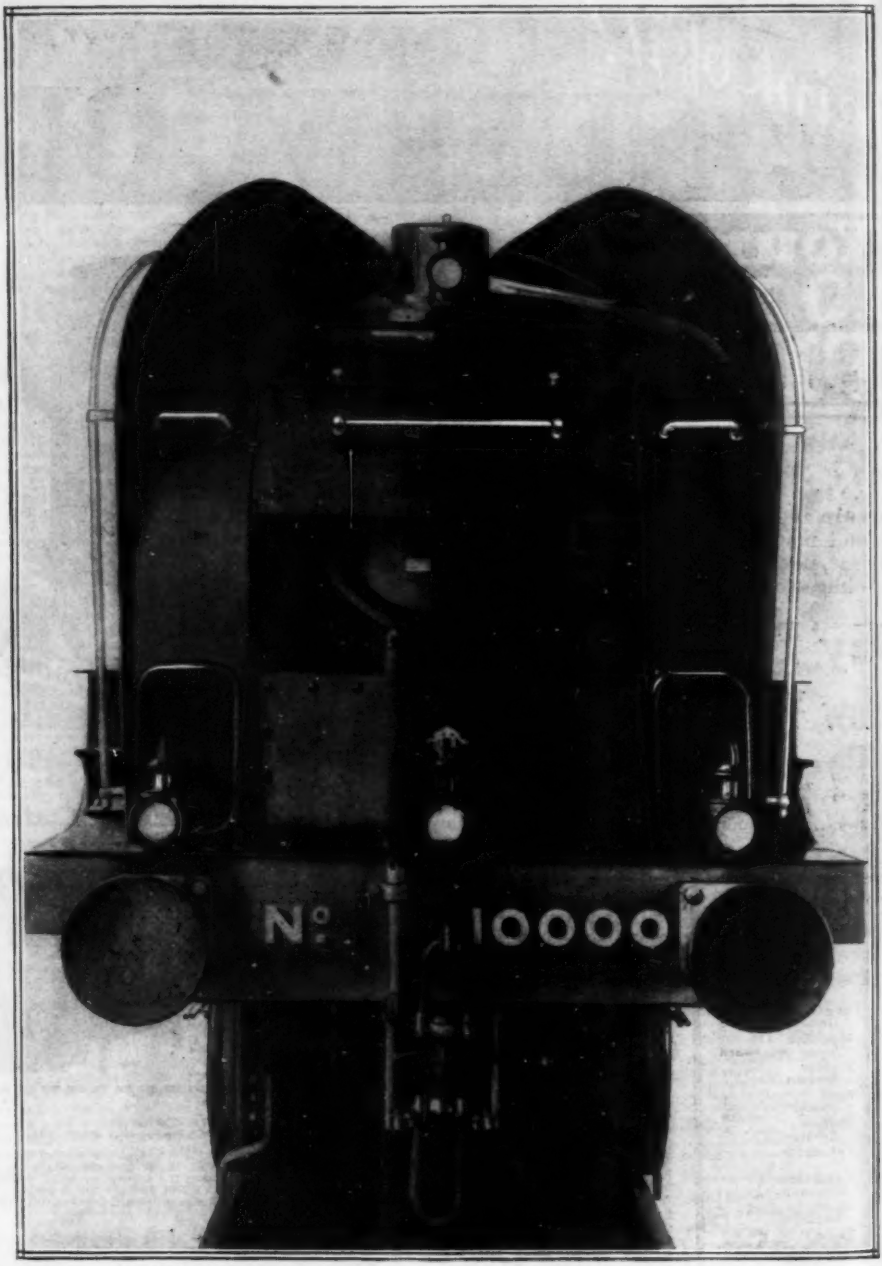
International Typewriter Exchange,
231 West Monroe St., Chicago, Ill., Dept. 394.

Please send the Underwood No. 4 at the special reduced price for 10-day Free Trial. I am enclosing $1.00 deposit with the understanding that if I am not perfectly satisfied I can return it Express Collect and get my deposit back. If I keep it I will pay $3 a month until I have paid $44.90 (*Term Price*) in full.

Name.....Age.....

Address.....

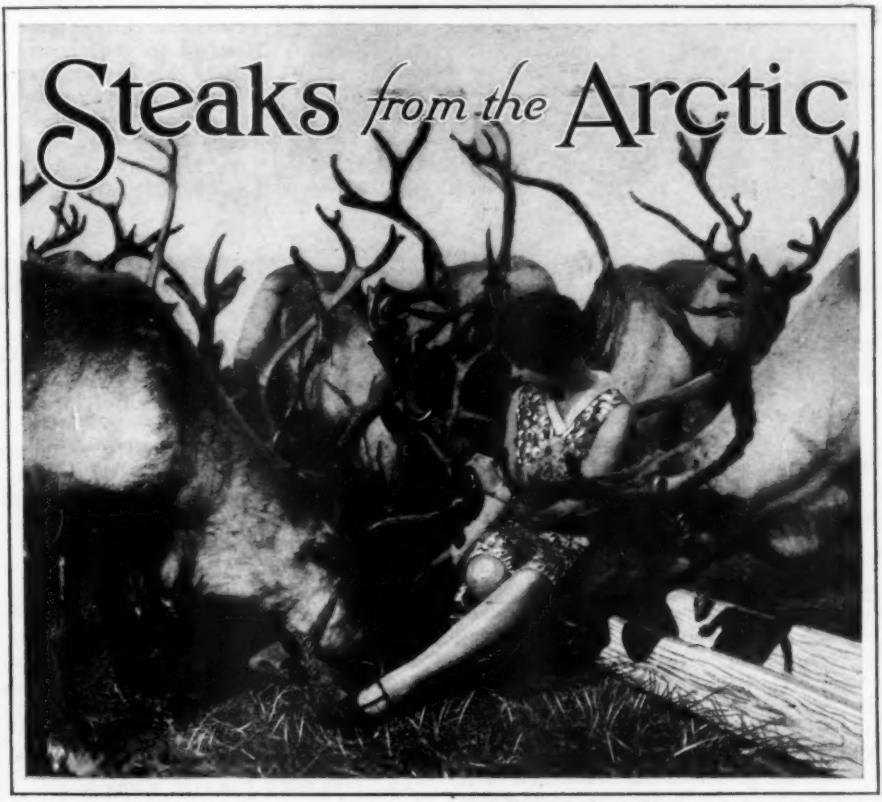
Town.....State.....



End View of British 170-Ton Passenger Locomotive, Its Boiler Occupying So Much Space None Was Left for a Smokestack Which Was Sunk within Casing Plates—See Page 383

Popular Mechanics Magazine
REGISTERED IN U. S. PATENT OFFICE
WRITTEN SO YOU CAN UNDERSTAND IT
Vol. 53 MARCH, 1930 No. 3

Steaks from the Arctic



Reindeer Quickly Become Tame and Friendly under Kindly Care; a Huge Herd of the Animals Has Been Sent into Far Northwest Canada to Supply the Eskimos with Food

By PATRICK DUFFY

ONE frosty morning last October an airplane roared into Nome and headed toward the Colville river. It was the aerial scout of one of the most spectacular treks in all history—nothing less than the movement of 3,000 reindeer across 1,500 miles of unpeopled, untimbered little-known arctic America. The herd has been purchased by the Canadian government and is being moved to Kittigazuit peninsula east of the historic Mackenzie river in the Northwest territories, from Kotzebue sound on the ice-ribbed shores of Alaska.

It is a story of charity in the grand manner, into which there is interwoven dog teams and airplane, Eskimos and big business—the primitive and the modern. The airplane scouts in advance of the herd, seeking suitable grazing and camping grounds and keeping the herdsmen in touch with civilization. The herd itself

Reindeer Meat on the Market; Eskimos along the Arctic Coast Formerly Depended upon the Caribou, but Few of These Animals Are Left

is accompanied by a picturesque caravan of forty specially made sleds drawn by fifty trained reindeer, to transport the equipment of the expedition. The herdsmen, mostly Eskimos, are aided by trained reindeer and sheep dogs, and will be on the trail for more than two years.

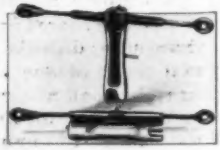
Next April the caravan will halt to allow for fawning, the journey being continued in the summer months. By the following spring it is hoped to have crossed the mouth of the Mackenzie river on the ice and to have reached the new range before the fawning season arrives. One of the advantages of reaching the new range at that time of the year is that reindeer possess a strong homing instinct, and young animals born that season will tend to settle the herd on the new pasture.

Since the dawn of history the Eskimos of the arctic coast have depended upon the herds of caribou for food, but the introduction of high-powered rifles resulted in the wholesale slaughter of these "camels of the frozen desert," and was one of the main reasons for the sudden disappearance of the herds from their usual haunts. Naturally the grim specter of famine haunted the igloos of the Eskimos. Many of them died of hunger. Many more, rendered weak by lack of food, fell easy prey to disease.

With promptitude the Canadian government rushed to the rescue of these kindly huntsmen. Food was sent by steamer, dog team and airplane, and it was decided that the Eskimos must no longer be left in utter dependence on the caribou, but must be provided with a sure source of food. With that end in view, the government investigated the reindeer industry of Alaska and the possibilities of the Northwest territories for reindeer ranching. As the result, the government purchased 3,000 reindeer, and the herd was started on its way. At the moment, of course, the government is bent on providing food and clothing for the Eskimos, but the venture may well give birth to an industry of great economic importance and thus repeat the history of reindeer ranching in Alaska, which now supplies more than $2,000,000 worth of meat to American cities every year.

PLANE TURNBUCKLE WRENCH TAKES SMALL SPACE

Capable of being operated within a space of one inch, a wrench for tightening airplane turnbuckles, the sleeve with a screw thread at one end and a swivel at the other, now is on the market. The wrench maintains its grip even if the hand is released, thus allowing quick work in inconvenient positions, or even in the dark. The steel pins of the tool may be replaced when needed and reinforced bifurcations prevent strain on the pins.



SEA HORSE SET ON SURFBOARD TESTS RIDER'S SKILL

Riding a surfboard attached to a motorboat did not provide enough sport for some of the winter colonists at Miami Beach, Fla., and as a result they started riding modern sea horses. In this sport, which gives many of the thrills of broncho busting, the rider sits astride a wooden horse mounted on a surfboard pulled by a power boat, and has a much more difficult time maintaining balance than when standing upright on the board without the horse.

Riding a Surfboard Pulled by a Speeding Boat Is Given an Added Thrill When the Rider Mounts a Sea Horse Attached to the Board; Above, Archer Testing Skill from His Unsteady Steed

XYLOPHONE LIKE A PIPE ORGAN ELECTRICALLY CONTROLLED

Embodying many of the principles of the pipe organ, xylophone and marimba, an instrument called the "marimba celeste" has been built for a concert player. It is played with mallets, but the tone is electrically controlled. The keyboard has three manuals and a range of eighty-seven notes. A section of the resonators, or pipes suspended beneath the bars, is fitted with microphones which transmit the sound to amplifiers similar to those used in radio. Two dynamic speakers are connected to two large horns at the front of the instrument. Pedals control stops and volume like those of a pipe organ. Another part of the resonators is fitted with disks which cause the tones from the pipes to have a tremolo.

DAYLIGHT SIGN FOR TRUCKS MOVES BY SUCTION

Advertising signs for auto trucks which change the reading matter automatically are being produced in England. The two lines of advertising are shown alternately as the sign oscillates to and fro, the movement being effected by a device resembling that which controls the ordinary suction-operated windshield wiper.

Oscillating Daylight Advertising Sign for Auto Truck, Operated by Suction from Engine

An Umbrella for the Automobile Which Fits in a Metal Case Attached to the Door of the Car

UMBRELLA FITS IN AUTO DOOR AS PERMANENT ACCESSORY

For traveling from the automobile to shop or theater in the rain, an English firm now is producing a small umbrella and a holder which attaches to the car door. The umbrella, with short handle, fits into a metal case covered with leather to blend with the car upholstery, the bottom of the holder containing a metal cup filled with absorbent sponge rubber.

GLASS SUBSTITUTE IS FLEXIBLE AND DOES NOT SPLINTER

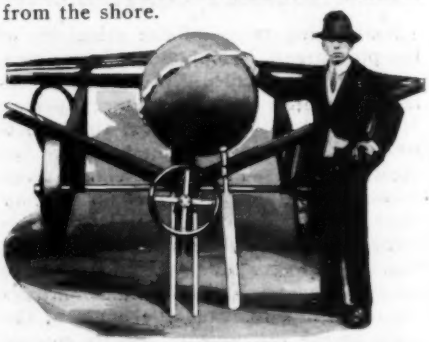
Hailed as a possible substitute for glass in automobile windows and windshields when further developed, an organic substance called "vitreo-colloid" is being manufactured by a British company. It is flexible, colorless and does not splinter, but at present it is being turned out in thin sheet form and is being used mostly for lamp shades. It somewhat resembles celluloid in flexibility, but is non-inflammable, more transparent and does not discolor with age. It is hard enough to prevent accidental scratching, can be readily cut, drilled or molded, and is an excellent insulator, which properties make it available for electrical use and in making toilet articles and phonograph records.

EARTH'S SPEED TWO HUNDRED MILES A SECOND

That the earth, together with a large section of the universe, is whirling through space at the rate of about 200 miles a second, has been proved by Dr. J. S. Plaskett, of the Dominion Astrophysical observatory at Victoria, B. C. Using one of the largest telescopes in the world and making observations over a period of six years, Doctor Plaskett and his associates have computed the speed of the movement, which had been suspected but not clearly measured. The earth is seen as a tiny member of a vast group of bodies which are speeding toward the constellation Sagittarius, so far away that its light requires 47,000 years to reach us. Our world thus has four motions, the astronomers reveal. It rotates on its axis, it makes a yearly trip about the sun, it is drifting with the sun in a random motion apparently not in the same direction as the "great whirl," and the fourth movement is that with the rest of the adjacent universe at the high speed which Doctor Plaskett emphasizes as being "more than 2,000 times that of the Schneider cup record."

CATAPULT FIRES BUOYANT BALL TO DROWNING PERSONS

Instead of throwing a lifeline, a catapult designed by a French inventor casts a large floating ball to drowning persons. The ball, with hang-on straps to which those in the water may cling, can be fired either from the deck of a vessel or from the shore.



Catapult Which Throws a Buoyant Ball, Instead of a Lifeline, to Those in Distress in the Water

HUNDRED-THOUSAND-DOLLAR PLANE—WHY IT WON

Curtiss "Tanager" Three-Place Biplane Which Won $100,000 Prize in the Guggenheim Contest; Note the Slots in Upper Wing and the Floating Ailerons on Tips of Lower Wing

Slow landing speed, quick take-off and other desirable features of the Curtiss "Tanager" three-place biplane, caused judges in the recent Guggenheim safety contest to award the $100,000 prize to the craft, which was entered after more than two years of wind-tunnel and other tests. During the trials, the ship showed a top speed of 112 miles an hour and the remarkably slow gliding speed of thirty-seven and one-tenth miles. Its minimum speed was thirty and six-tenths miles. It came to stop after a ninety-foot roll upon landing and took off within 300 feet. It hopped a barrier thirty-five feet high and halted within 295 feet of the base of the hurdle. On a reverse performance, it cleared a barrier of the same height 500 feet from the start. The ship's rate of climb was 600 feet per minute. With the throttle wide open, it displayed an endurance of three and six-tenths hours and a range of 405 miles. The service ceiling was 12,500 feet. The craft weighs 1,959 pounds empty and 2,841 pounds fully loaded. It has a span of forty-three feet, ten inches. Three innovations proved important factors in the ship's performance. These were its new type of ailerons, of the floating kind that automatically assume a position parallel to the air currents set up by the ship; automatic wind slots and controlled wing flaps. The ailerons may be moved relative to each other by the pilot and give control in a stall and at high speed as well as reducing yawing and spinning. Their action makes rudder correction and control unnecessary. During the Guggenheim tests the "Tanager" was flown in tight vertical banks without the use of the rudder through the function of the floating ailerons. They are mounted on the tip of the lower wing. When the plane is moving forward in level flight, they remain level and even with the lower wing and operate directly into the wind no matter what position the plane assumes in the air.

AUTOMATIC AIR VENTS PROTECT BUILDING FROM TORNADO

Swinging windows and hinged skylights or roof panels in buildings in tornado districts will prevent much of the damage from such storms, experiments have shown. By placing automatic vents in from ten to fifteen per cent of the wall and roof area, the explosive effect of low air pressure outside is much reduced.

TOP THAT SPINS A MAN SHOWS EFFECT OF GYROSCOPE

Tipping the Spinning Wheel Either Way Turns the Man on Ball-Bearing Platform

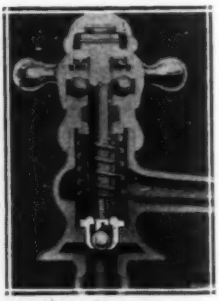
Remove the tire from a detached bicycle wheel, substitute a lead strip around the rim, adjust two handles to the hub and you have a powerful gyroscope that will spin you around on a ball-bearing platform and will do other interesting "stunts." The wheel may be set in rapid rotation by striking the spokes with the fingers or it may be wound up with a cord around a collar on the hub, although this is not a necessary addition. Holding the wheel as shown in the accompanying photograph, then turning it at an angle from the perpendicular, causes the operator to revolve at considerable speed on the turntable. The direction is reversed simply by tipping the wheel the opposite way. Weighted with ten pounds or so of lead, a bicycle wheel with good bearings will spin for ten minutes or more at high speed when set in motion. The "top" will spin on either handle, balance itself on a string and do many other fascinating tricks.

SURGICAL DRESSINGS OF WOOD PULP PROVE WORTH

Impressed, but not entirely convinced, by the claims for a wood-pulp (cellulose) material, designed to take the place of absorbent cotton for wound dressings, surgeons in a Boston hospital decided to test the qualities of various dressings offered to them. Aside from the sterility of the materials, which is proved in all cases, the main point at issue was their respective ability to absorb blood. The laboratory technician presented his report in a graphic manner. He had compounded a liquid as nearly as possible of the consistency of human blood and colored it with a dark aniline dye. One drop of this liquid, he let fall on the surface of each material and all were allowed to dry under exactly the same conditions. The stain on the wood-pulp material covered twice the area and showed nearly twice the penetration as compared with the best grade of absorbent cotton.

BALL VALVE SHUTS OFF WATER WHEN FAUCET IS REMOVED

Adapted for any modern plumbing fixture, an automatic ball shut-off valve which operates when a faucet is removed, now is on the market. The fixture makes it possible to replace a worn gasket without using the water cut-off. The valve is a brass housing which screws into the faucet and contains a steel ball which is forced by water pressure against a watertight seat in the housing to stop the flow of water when the faucet is removed. A pin extending into the housing holds the ball away from the seat when the faucet is in place.

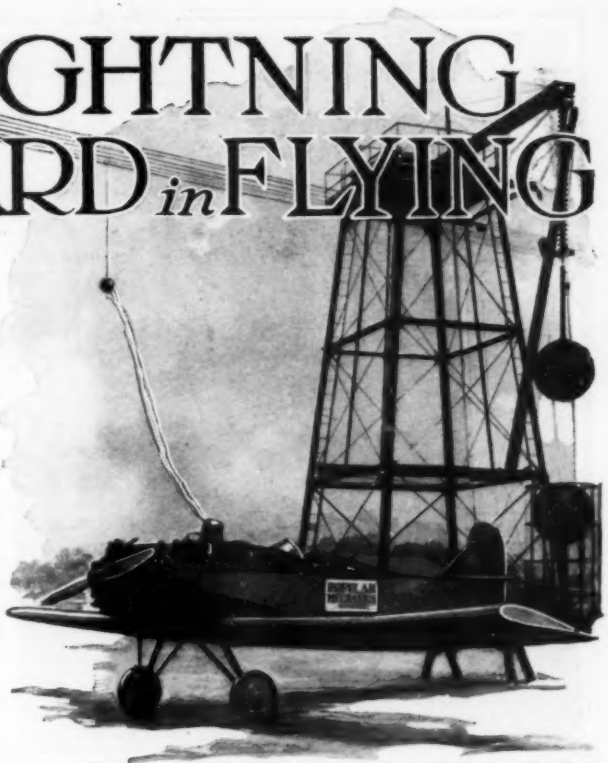


The LIGHTNING HAZARD in FLYING

By W. E. BURTON

PROOF that lightning can strike an airplane while it is in flight, and evidence that certain portions of the plane structure are more susceptible than others to bolts are among the early findings of Arthur O. Austin, who is conducting, in co-operation with Popular Mechanics Magazine, a series of tests to determine the effect of lightning on heavier-than-air craft.

Mr. Austin is chief engineer of the Ohio Insulator Company and consulting engineer for the Ohio Brass Company. He is using the most powerful outdoor high-voltage laboratory in the world at Barberton, Ohio, for the experiments.



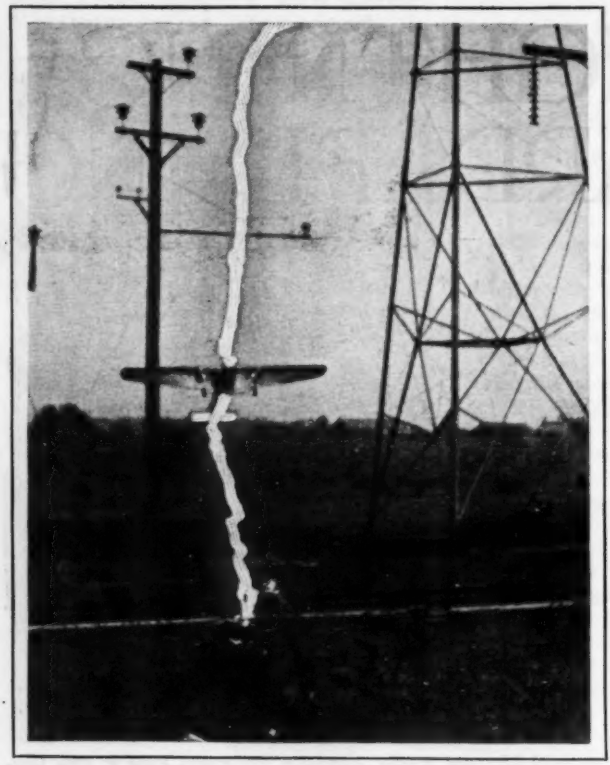
Artificial Lightning Striking Dummy in Full-Rigged Plane at Ohio Insulator Company, Barberton, Ohio, Where Tests Are Being Conducted

By subjecting scale models, completely insulated from the earth and other objects, to artificial lightning whose voltage runs into the millions and amperage into the hundreds of thousands, Mr. Austin has demonstrated that a plane in the air can be struck in any of several different ways. In general, the lightning discharge usually will strike a projecting portion of a plane, and leave by a similar projection at some other point.

Thus, the bolt might enter at the rudder tip and leave by a landing wheel or wing tip; strike one wing tip and leave by another; travel from the propeller or some point on the engine to the tail skid or rudder, or strike a projecting radio mast or antenna and leave by a wheel, rudder or other projection. In one case, it was shown that the pitot tube of the air-speed indicator, projecting from the front of a wing of a model tri-motored monoplane, acted as the doorway for the bolt.

These, according to Mr. Austin, are among the more common ways in which a plane can be struck, but so much depends on the structure of the plane itself—its relative dimensions, shape of parts and placement of various units—that no hard and fast rules can be formulated for predicting the exact point at which a bolt will enter. The tests so far conducted indicate that in practically every case complete protection from lightning danger can be provided by proper design or by the use of adequate electrical shielding and bonding.

Following preliminary experiments with models, further tests were conducted on a Barling NB-3 all-metal frame, fabric-covered monoplane provided for the purpose



Model Plane Being Struck by Artificial Lightning; the Bolt Passed In at the Propeller and Out at the Tail of the Ship

by Popular Mechanics Magazine. The plane was placed on the ground and subjected to impact discharges of artificial lightning, to determine, among other things, vulnerable points and the effect of the discharges on the motor, tail group, propeller and other parts.

Repeated hits were obtained on the propeller, which was of wood with a metal capping that extended to within a few inches of the hub. The discharge, striking the propeller tip, traveled along the metal and then jumped across the intervening few inches of space to the motor, striking, in most cases, the nearest spark plug. All plugs had been grounded to the motor to prevent damage. This indicates that the propeller can pick up a discharge and carry it to the ignition system, with possible damage to the magneto, wiring or other vital part.

Further tests with the LeBlond 60, dual-ignition, radial air-cooled motor on the Barling revealed that the artificial lightning bolts would not stop it while it was idling. Strikes were obtained on the propeller and the cylinders. The top front spark plug had been grounded as a means of protecting the ignition, as it was anticipated that the charge would pass from the propeller sheathing direct to this plug. It is yet to be determined whether motors of other types or with different propellers will likewise continue to run under the lightning bombardment.

Strikes were obtained on other parts of the plane. Those entering the top of the rudder were of interest. Holes were produced in the fabric at points where the discharge struck. These holes, about the diameter of a lead pencil, were caused by the instant vaporization of the fabric material under the intense heat, the resulting explosion causing the fibers to be thrown outward. The rudder had a duralumin frame, and the strikes occurred at the points where the fabric was stretched over the frame.

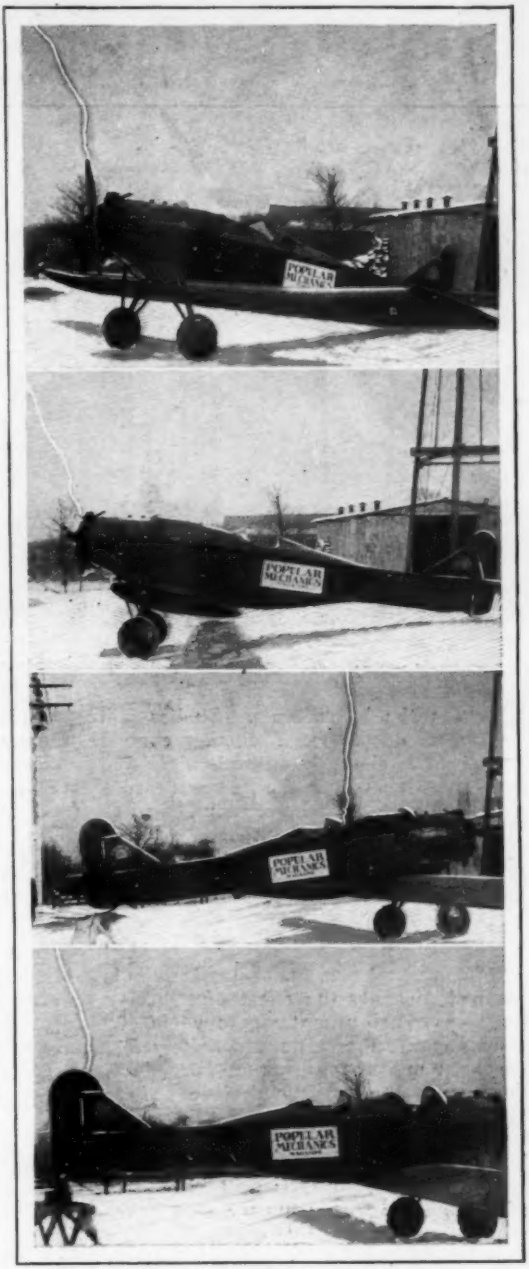
The question of fire hazard to airplanes during a thunderstorm—whether a bolt will set fire to the fabric of a wing, for instance—is one that involves a large portion of chance, Mr Austin claims. The producing of fire is determined largely by the materials of the fabric or paint and the rapidity with which heat is dissipated. Vaporization of moisture and fabric materials might produce a cooling effect great enough to prevent fire.

Investigation so far carried out, especially that with running motors, has indicated that there is apparently no danger of hot exhaust gases from the engine cre-

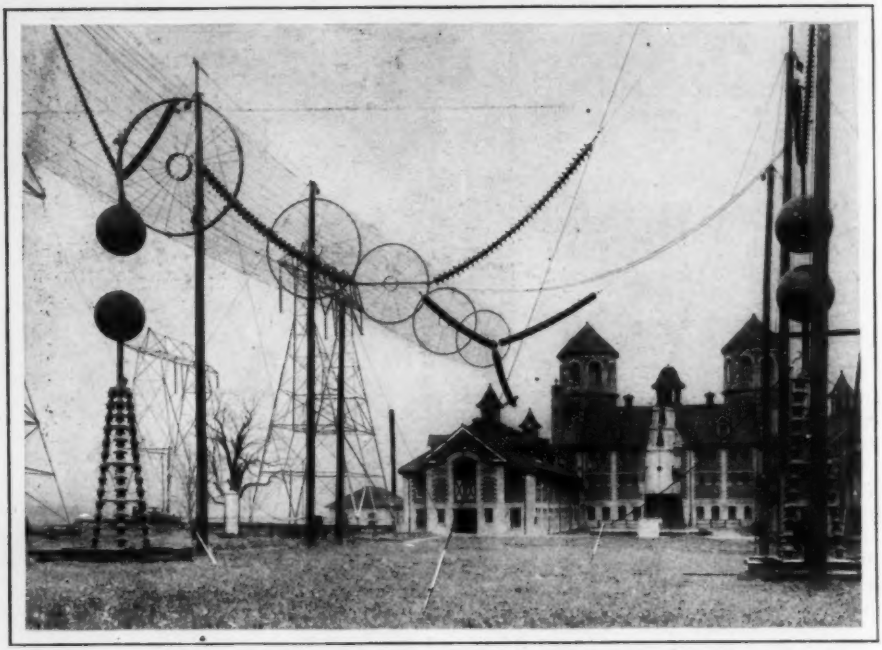
ating a path for lightning. This point is one that has been puzzling airplane men and others who have speculated on the possibility. Mr. Austin has found evidence that the heat is so rapidly dissipated, and that the propeller, in churning the air, so effectively breaks up the streams or threads of hot gases that no path is produced. Studies of this aspect of the lightning hazard have not been completed.

The tests, which have been in progress for several months, are scheduled to continue perhaps into the summer. There are a number of problems that will be studied in addition to those already attacked. One of the most important is the effect on pilot and passengers of a sudden collapse of an electrostatic field through which the plane is flying. Such a collapse occurs when a lightning discharge, not necessarily striking the plane, takes place in the immediate vicinity. Mr. Austin believes that the sudden breakdown of the field may induce such a high voltage on the ship that human occupants would receive a severe shock. Furthermore, there may result a discharge between two isolated masses of metal in the plane, so that fire or other damage might result. He believes that there is more likelihood of this occurring in an open-cockpit plane and in one that is not well bonded, than in a closed-cabin, well-bonded ship, especially the all-metal type.

An inquiry also will be made to determine whether lightning will cause fire or explosion in fuel tanks, or in the engine crankcase where there often is an explosive mixture of gasoline and oil vapor. Explorations of the charges on various parts of a plane, as inside the cabin, when the ship is in an electrostatic field, will show the manner in which charges in the cabin or cockpits are distributed and their



Four Hits Scored at the Barberton Laboratory Field; Propeller, Cylinder Head, Fuselage and Rudder of Full-Rigged Ship, Subjected to Bolt of Artificial Lightning



View of Part of Plant of Ohio Insulator Company at Barberton, Showing Some of Equipment Producing Artificial Lightning, Whose Effect on Airplanes Is Being Studied

effect on the instruments. Studies will be carried out to learn whether control cables are likely to be fused by lightning bolts, and whether a charge on the rudders or ailerons will be communicated to the control stick and rudder bar, and thence to the pilot.

Various general types, including all-metal cabin planes, fabric-covered wood-fuselage ships, open-cockpit jobs, planes with various kinds of wing structure, and so on, will be tested. Likewise, it is planned to study the effect of lightning on various kinds of motors, propellers, etc.

This is the first time a definite effort has been made to learn the truth about lightning as it affects the airplane. There has been, until recently, a prevailing opinion that a plane in flight cannot be struck by lightning. But the findings at the Barberton laboratory, as well as reports of pilots all over the country, sent in response to a questionnaire submitted by Popular Mechanics Magazine, indicate conclusively that there is a real lightning hazard. The comparative lack of trouble from lightning in the past is attributed to the facts that planes have been keeping on the ground during thunderstorms, largely because of the violence of air currents, and that the number of planes has not been great enough to make the lightning hazard a large factor. But now that air travel is becoming more general and constant, the role that lightning plays is taking on a new significance.

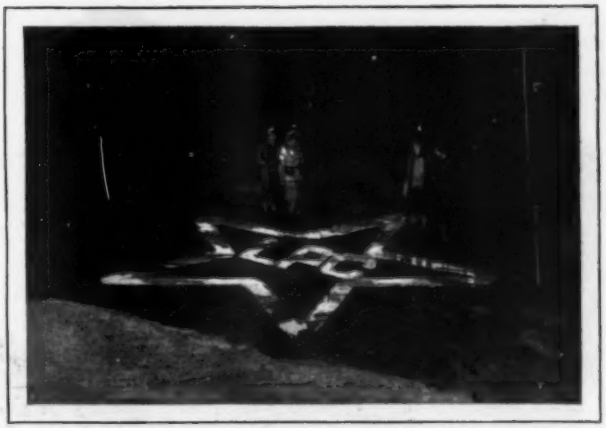
It is to provide the airplane designer, builder, operator and user with definite information, making possible adequate protection from lightning, that the tests are being carried out at Barberton.

SUBSTITUTE FOR METAL CANS AND GLASS CONTAINERS

Having the strength of metal and the transparency of glass, a possible substitute for metal cans and glass containers for preserving foodstuffs has been found in a cellulose product. The material was discovered accidentally in the laboratories of a manufacturer of photographic film.

LEAD ALLOY MORE EFFICIENT THAN PURE METAL

Experiments to determine the cause of breakdowns in lead cable sheathings by the British non-ferrous metals research association have resulted in the discovery of a lead alloy, only two-thirds as heavy as the pure metal and possessing many superior qualities from an industrial standpoint. The alloy consists of 98.25 per cent lead, one and one-half per cent tin, and the rest cadmium. Tests show that pipe made from the alloy is cheaper, lighter, has eighty-four per cent more tensile strength, offers greater resistance to vibration, and, in certain corrosive waters, is more durable than lead itself.



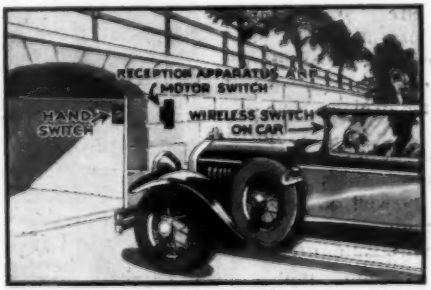
Electric-Light Bulbs Frozen under the Surface of the Ice Furnish Illumination for Skating at Night on Lake Placid

ELECTRIC LIGHTS FROZEN IN ICE THRILL NIGHT SKATERS

Skaters of the Lake Placid club in the Adirondacks have enjoyed illuminated night skating this winter through a plan of freezing incandescent electric-light bulbs beneath the surface of the ice. The lights were placed in various artistic patterns, and at night the part of the lake reserved for skating was lighted with the sunken bulbs.

RADIO OPENS GARAGE DOORS AND CLOSES THEM

A Swiss inventor has developed a radio device by which he can open and shut his garage doors without getting out of his car. Antennæ set inside the garage receive waves emitted from the car, setting in motion a small motor which raises a steel roller blind in the garage. As he approaches the garage, the autoist presses a switch on the dashboard of his car, and drives straight into the garage as the roller blind automatically goes up. When he alights from the car, he presses another switch inside the garage and the steel blind falls. When he wants to drive out of the shed, he switches the roller blind up, drives out and when clear of the garage, touches the switch on his dashboard and the garage door closes behind him.

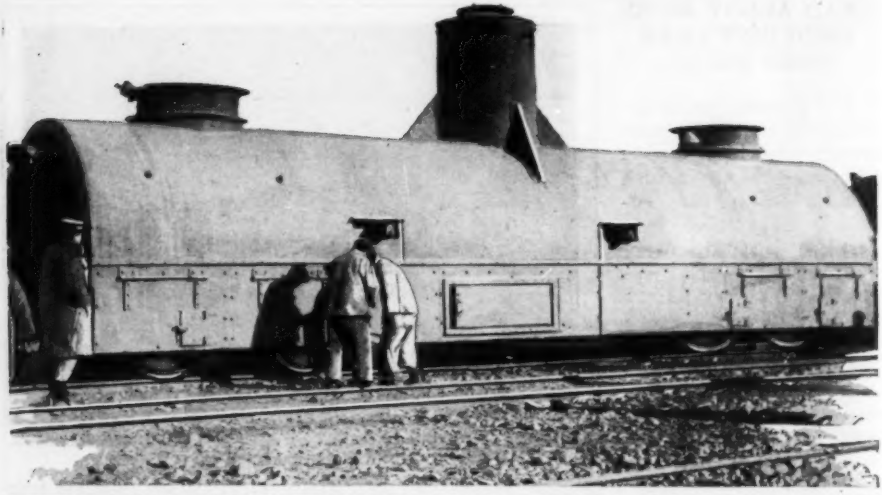


Courtesy London Daily News

Radio Apparatus in Auto, Signals from Which Cause Garage Door to Slide Open or Shut

BEST LANDING-FIELD SURFACE

Landing fields covered with whitewashed crushed stone can be seen by aviators coming through a dark sky fifteen times as well as fields covered with asphalt, aviation lighting engineers have determined. Fifteen times as much illumination is required for the asphalt field as for that of stone. The latter reflects seventy-five per cent of the light it receives, and the asphalt five per cent. Reflection factors for other materials are thirty per cent for cement, and twenty-five per cent for ordinary crushed stone.



Armored Railway Car Employed by Chinese Nationalists in Recent Fighting; It Is Covered with Heavy Steel Plate, with Turrets for the Guns in the Center and at Each End

ARMORED CAR LIKE OIL TANKER USED BY CHINESE

Somewhat resembling an American oil-tank car, an armored railway car has been used by the Chinese nationalists in victorious battles of recent months. The formidable instrument of war is constructed of heavy steel plate with a gun turret in the center and smaller ones at each end, while openings for more guns are provided on the sides and ends.

MOVIE FILMS ARE PRESERVED IN SPECIAL CONTAINER

Constructed on the principle of a humidor, a container for movie films now is available, intended particularly for keeping home films always in condition for projection. It consists of two aluminum boxes, one within the other. The outer one is lined with cork and a dead-air space of about half an inch is provided between the boxes. A humidor pad is fastened to the bottom of the inner container and is moistened with water before the film is placed inside and the air-tight covers of the boxes are locked. The holder has space for three 400-foot reels, and also protects against fire.

CHEMICAL MUFFLER REMOVES CARBON MONOXIDE

To eliminate the deadly carbon monoxide from the exhaust gases of automobiles, a muffler containing a chemical element has been produced to replace the ordinary muffler. Carbon monoxide is odorless, colorless and tasteless, which accounts for the fact that it claims the lives of many motorists who thoughtlessly warm up an engine in a closed garage. The chemical element, the exact nature of which has not been revealed, is known to be a catalyst, a substance causing a chemical reaction without itself participating, and transforms carbon monoxide to carbon dioxide, the same gas breathed from the lungs. The canister of the catalyst is substituted for the muffler, deadening the noise of the engine explosions and at the same time removing all the unburned fuel gases, the ill-smelling as well as the deadly. The catalyst has the task of consuming about half as much fuel as the engine, and possibly the heat may be used to warm the car.

ELECTRIC ROBOT GUIDES PLANE WITHOUT AID

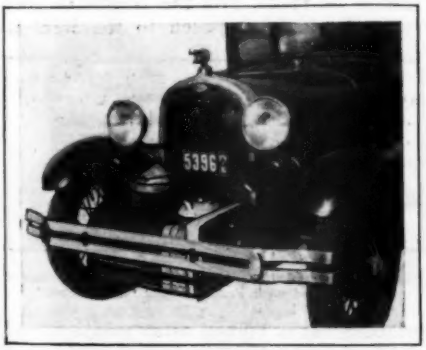
Operated by electrical impulses, a robot that guides an airplane and keeps it on an even keel without aid of the pilot, except in taking off and landing, recently underwent successful tests. The electric robot differs from the gyroscopic robot in that two vanes, mounted on the forward edge of the wing, transmit variations in the air stream to a pendulum which in turn regulates electric motors operating stick and rudder. Down and upward currents are detected and corrected through electrical and mechanical connections with ailerons and elevators.

Courtesy I. Kittle

Diver Wearing Apparatus Which Dispenses with Helmet; Tube to His Mouth Is Attached to Oxygen and Carbonic-Acid Gas Supply

CARRIER RACK AT FRONT OF CAR PROVIDES EXTRA SPACE

Space for extra luggage is provided in a carrier rack which fits at the front of Ford cars in the space between the bumper and the radiator. It consists of a metal support, twenty-four by eighteen inches and nine inches deep, and will carry 400 pounds. It has more road clearance than the car and can be slipped into place or detached without the use of any tools.



Luggage Rack for Front of the Auto Which Provides Extra Space for Bags and Bundles

HELMETLESS DEEP-SEA DIVER DODGES PERILS

A new deep-sea diving apparatus which dispenses with the need of a helmet was recently tested at Lowestoft, England. The diver, using this apparatus, wears a coat of white flannel, while the apparatus, comprising oxygen and carbonic-acid gas absorption cylinders, is strapped round his waist and back of his head. He breathes and exhales the used air through tubes connecting the cylinders, while goggles are strapped over his eyes.

SUGAR PRODUCED BY GERMS OFFERS DISEASE CURE?

By means of a form of sugar produced by tuberculosis germs, scientists are hoping to find a new way to cure the malady. Dr. William Charles White, of the United States public-health service, reports that this sugar is the chemical bond between the tuberculosis bacillus and the kind of human body cell in which the germ thrives and spreads. If the bacillus can be separated from this cell, it can no longer cause the disease and a positive cure may be obtained. The sugars are harmless to healthy persons, but may be fatal to those afflicted with tuberculosis.

© Henry Miller

View of Elaborate Eighteen-Hole Indoor Golf Course Containing a Stream Stocked with Trout as an Extra Hazard for Players

BROOK ON INDOOR GOLF COURSE OFFERS OUTDOOR HAZARD

One of the most elaborate and largest indoor golf courses in the world has been built in the St. Paul athletic club. One feature of it is a stream, stocked with live trout, which meanders over the course, bridges spanning it at various places. The course itself is a regulation eighteen-hole affair, and besides the stream, sand traps and other hazards are provided. Cotton-seed hulls, dyed green, give the effect of grass and, with imitation trees, add to the outdoor appearance.

TUNNEL FROM SPAIN TO AFRICA

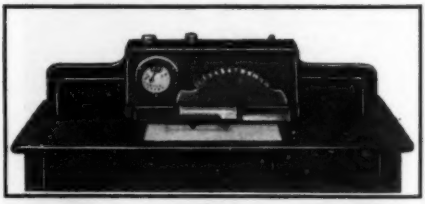
Spanish engineers are considering the possibility of linking the Spanish mainland with the African coast by the longest tunnel in the world—twenty miles from end to end, and 1,500 feet below the surface of the water in the Strait of Gibraltar at the mid-point. A preliminary shaft has been sunk to determine rock formations. Although the strait is only eight miles wide at the narrowest point, the great depth of the channel and the presence of rock too hard to bore, make a tunnel there impracticable. From the shaft, further explorations are to be undertaken by means of sound waves.

BRIDGE SPAN RIDES ON BARGES TO POSITION

When contractors were refused permission to close the Illinois river to construct the draw span for a bridge at Pekin, they erected the falsework on shore and built the 260-foot span there. When the span was completed, the falsework was removed and replaced by supports on barges filled with water so that they sank to the deck level. With five barges in position and the ends of the span still resting on the falsework, the boats were emptied of the water, thus raising the 450-ton load from its old supports. By means of cables attached to another bridge, the mammoth flotilla then was hauled 500 feet to the channel, swung into position and, by again sinking the barges, was lowered onto its permanent supports.

ELECTRIC EYE MARKS PHOTOS FOR BEST PRINT PAPER

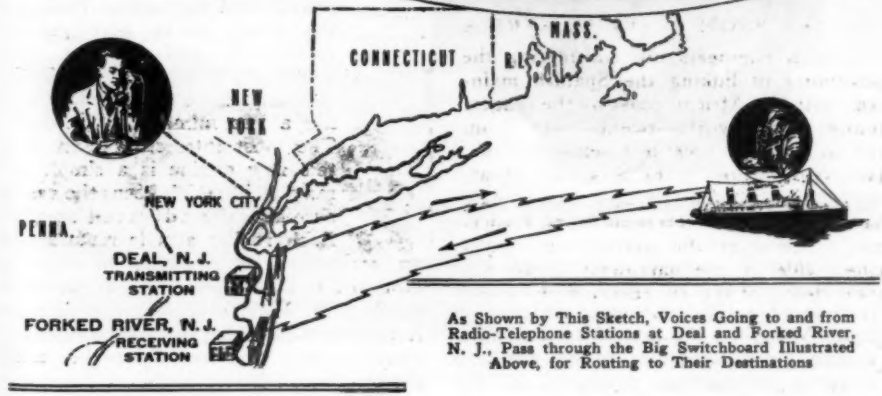
Doing a task heretofore performed only by a skilled photograph worker, an instrument now is on the market which marks on photographic negatives the proper grade of paper on which each print should be made, and the length of time each should be exposed to the light in printing. It is known as a "printometer" and is operated by electric and mechanical devices as the negatives are exposed.



Photographic Negatives Exposed to This Instrument Are Marked with Proper Paper for Printing

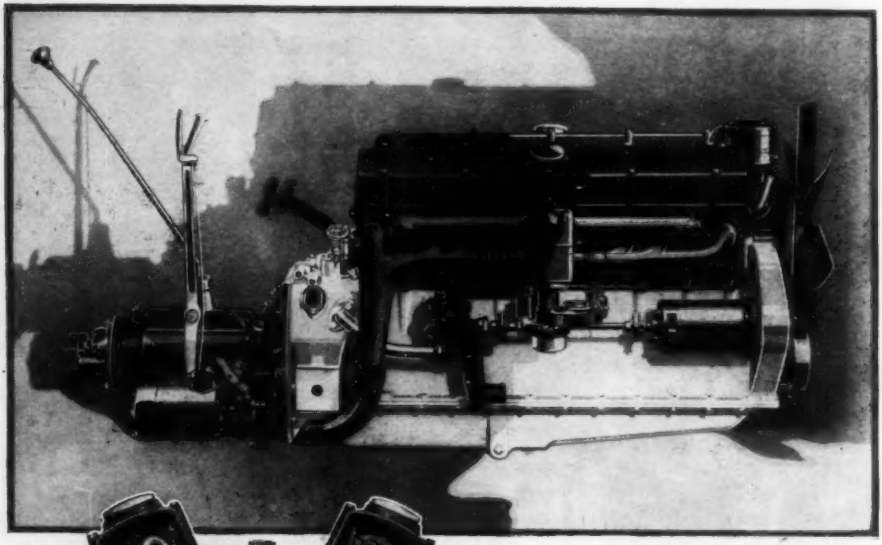
SHIP-TO-SHORE TELEPHONE LINK PROVES A SUCCESS

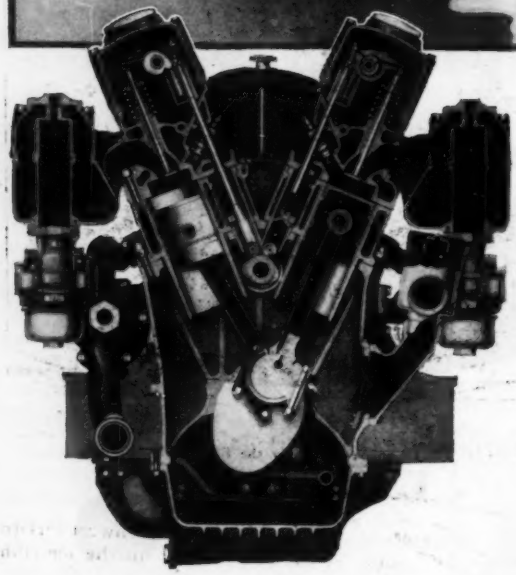
Foreign-Service Section of Switchboard in American Telephone and Telegraph Office at New York; Interior of Deck House on S. S. "Leviathan," Which Houses Short-Wave Radio-Telephone Equipment, and Diagram Showing Path of a Call between a Shore Telephone and Moving Vessel



As Shown by This Sketch, Voices Going to and from Radio-Telephone Stations at Deal and Forked River, N. J., Pass through the Big Switchboard Illustrated Above, for Routing to Their Destinations

SIXTEEN-CYLINDER MOTOR LATEST AUTO WONDER





Above, Side View of Sixteen-Cylinder Cadillac Power Plant; Below, Cross Section of the Engine, Front View

To provide unusual acceleration, hill-climbing ability and speed, Cadillac has introduced a 175-horsepower sixteen-cylinder V-engine, the first sixteen-cylinder engine for automobiles to be put into quantity production anywhere in the world. It consists of two eight-cylinder blocks forming a forty-five-degree "V," bolted to an aluminum crankcase. Each block has a separate carburetor and separate intake and exhaust manifolds, all placed on the outside of the "V," where they are readily accessible. The purpose in adopting the sixteen cylinders rather than twelve or eight cylinders was to insure extreme smoothness, since the relatively small pistons and connecting rods and the short stroke give greater smoothness and silence than would be attained in an engine of the same piston displacement having a less number of cylinders. The most interesting feature of this new engine is a simple arrangement which keeps the valves automatically adjusted at zero. Each rocker arm is mounted in an eccentric sleeve which in turn is mounted on the rocker shaft. If the valve mechanism tends to become too tight or too loose, the bushing is automatically rotated to raise or lower the rocker until the clearance becomes zero.

AIR IS KEPT WARM OVER ARCTIC BY OZONE

Why is the upper air over the arctic warmer than it is over the equator? The question long has puzzled scientists and still remains a mystery, but Dr. W. J. Humphreys, of the United States weather bureau, offers a partial explanation by the fact that there is a thicker "blanket" of ozone over this part of the globe than over the equatorial regions. This has been determined by observations, and as ozone absorbs radiations from the earth and reradiates part of them back again, there is less heat loss where ozone is plentiful.

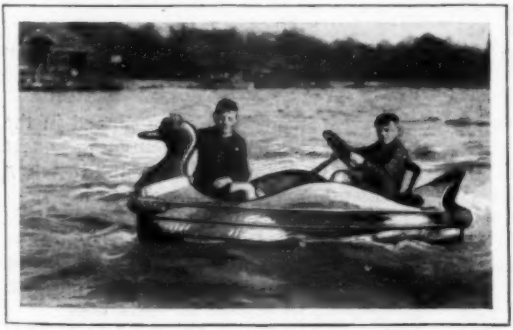
Resembling an American Grain Elevator, This Striking Piece of Architecture Is in Reality a Club for Moscow City Workers

CLUBHOUSE LIKE AN ELEVATOR FOR MOSCOW WORKERS

Resembling an American grain elevator or coal chute, a clubhouse, strikingly original in architectural design, is nearing completion in Moscow. The building will be occupied by the municipal workers of the Moscow city district.

BOAT IS PROPELLED BY PEDALS AND GUIDED LIKE AUTO

Propelled by means of pedals in the bottom of the craft which connect to oars, and guided by a wheel like an automobile, a children's boat in England is attracting much interest. Children's sizes are built to resemble various water birds, and adult models also are being made with two or more sets of pedals. No experience in rowing is necessary to operate the craft which can make a speed of three or four miles an hour.

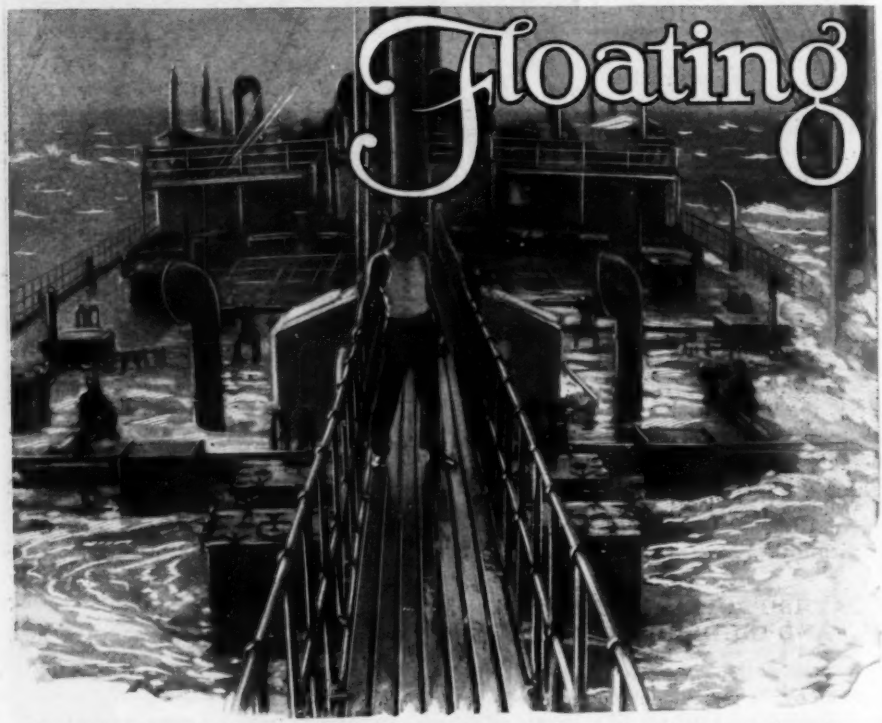


Children's Boat, Built to Resemble a Duck, Operates with Pedals and Is Steered like an Automobile

RUBBER REPLACES METAL

There has recently been produced a new kind of rubber which is said to possess superior properties. This material is made direct from the latex, permitting a more thorough mixture. It can be turned out only in sheet form, but the sheets, through the use of a special solution, can be built up into a variety of shapes. The Malay tin mines were among the first to apply this material, and they used it instead of white iron and manganese for lining launders and chutes of dredges. Although much lighter than the metal lining, which had to be removed every four or five months, the rubber material has shown no signs of wear after eighteen months of service. Shoes of gravel pumps, throats of hydraulic elevators, and bores of pipes conveying abrasive mixtures have been similarly protected.

Floating



On a Tanker's Fore-and-Aft Bridge, a Structure Made Necessary by the Fact That the Deck, as Shown Here, Is Frequently Awash during a Voyage

By DON GLASSMAN

THE HEYDAY of tankers is here. It comes with the age of oil, the age of mechanical locomotion and exploitation of the earth's petroleum.

Thirteen hundred and twenty-four tankers, aggregating 10,500,000 tons, ply the ocean's trade routes. During one year, they transport almost a billion barrels of petroleum and its products.

The search for oil is no less heroic than the search for gold. Companies with billions of capital send wizard geologists into jungles, deserts, snow fields and lonely islands to find rock structures favorable for drilling. And so they have gone into the Persian desert, into the jungles of Colombia, lava-baked plateaus of Mexico and cannibal lands of New Guinea. Then come engineers, drillers, riggers and at last towers that point like daggers into the clouds. A steel bit bores bedrock. The hole goes down hundreds, thousands of feet. A million dollars in a hole! One day, as the rigging crew lunches under a tree, in a South American jungle, one hears a muffled boom, followed by a column of back mist.

"There she blows!"

Oil—liquid gold—comes spouting from the earth like water from a geyser, 30,000 barrels a day.

A great gusher has been tapped in the heart of a jungle, where venomous snakes are more common than men, and the chug of an automobile has never been heard.

Transferring oil to the coast usually necessitates a pipe line. And laying one pipe in a jungle may equal the ransom of a king. Millions of dollars are expended on arteries to convey oil from wells.

Now the tanker enters the picture. The first tankers, in the nineteenth century,

Oil Tanks

Firemen Fighting a Blaze on a Big Tanker That Sank at the Wharf in Philadelphia with the Loss of a Valuable Cargo of Linseed Oil; the Fire Required Use of Chemicals

were sailing vessels, and carried cylindrical vats of a capacity of several hundred barrels. Today some tankers have reservoirs that might comfortably hold a schooner and all her equipment. The world's largest tanker, the "C. O. Stillman," is under the Canadian flag, and can transport 163,000 barrels, besides crude oil for her own Diesel engines. The second largest tankers are the "John D. Archbold" and "John D. Rockefeller," sisterships under the American flag.

On a crack tanker, there are from thirty-five to forty-five men in the crew. Either at sea or in port, the life on board is no humdrum existence. And contrary to prevailing belief, the crew's quarters are not grimy and greasy. One is hardly aware of a cargo aboard, for it does not require attention. In discharging and filling her reservoirs, a tanker rarely loses a drop. As a matter of safety, as well as economy, all shore connections are perfectly tight.

As long as oil can be drawn from rock, tankers will plow the seven seas. They have advantages over railroads. When one oil field is drained, the route of tankers is merely shifted to another scene. But in the case of a railroad or pipe line, much equipment must be junked. Since the service life of a tanker is from twenty to twenty-five years, there is ample time for the owners to realize profits. While the principal products carried are crude oil and gasoline, there is also some commerce in kerosene, furnace oil, gas oil and lubricating oil.

A reservoir cannot be used to carry different oil products unless it has had a thorough cleaning. This is an elaborate operation and is carried out in port by special crews. The first step is a bath from smothering steam lines that force hot vapor into the tanks under a pressure of 200 pounds for eight hours. Then the tank lids are raised one at a time, and the inside walls washed with hot water thrown

by hose. A chemist analyzes the tank air before men are allowed to climb down. If he finds the air non-poisonous, a cleaning crew descends.

One enjoyment denied a tanker's crew is smoking all over the ship. It is permitted only in one's quarters, and is prohibited everywhere when the ship docks. On a steel tanker, there is little chance of fire breaking out; indeed, it has happened rarely, since the tank covers are clamped down tight, and volatile gases are carried off through pipes alongside the masts.

When loaded, a tanker's freeboard is frequently as low as seven feet. The long, low deck amidships is swept by breakers, and the ebb tow is powerful enough to carry an able-bodied man off his feet. When a tanker is bucking a strong swell, the crew communicates with different parts of the ship by way of the fore-and-aft bridge, which runs from amidship quarters to after quarters, along the backbone of the ship.

Tanker crews have their adventures, of course. In a recent hurricane along the Florida coast, the good tanker "E. J. Sadler" ripped into snorting winds and a black fog at ten knots.

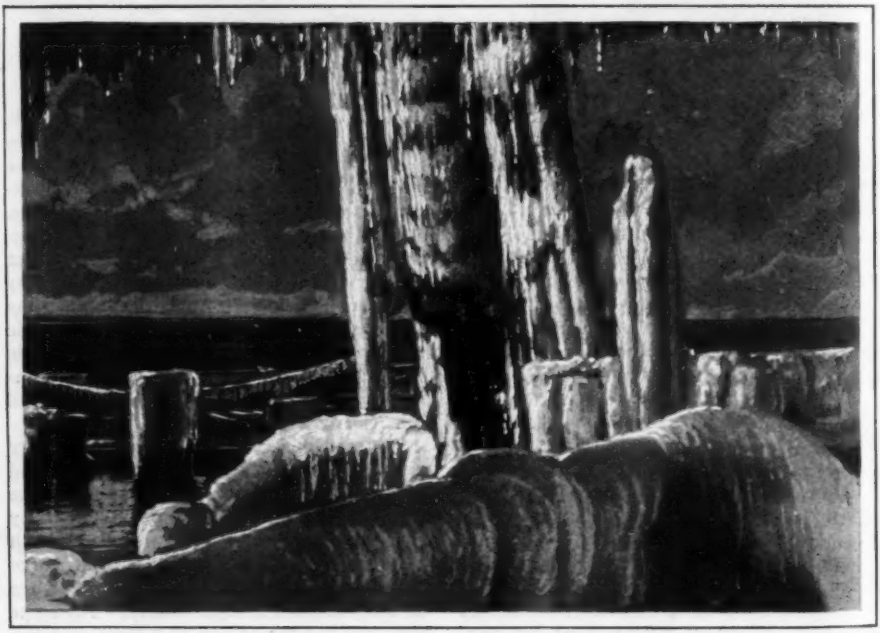
It was midnight. The sudden wild chatter of the radio awoke the operator with SOS signals; a message from another tanker, the "Garnet Hulings."

"On the rocks!" said the "Garnet Hulings'" wireless, "and pounding badly."

"What's your position?" asked the "Sadler."

"Not sure, but think it's near Sombrero reef."

That meant little to the skipper of the "Sadler" on a night when the world was a wind tunnel, and his vessel was lashed by whipping breakers. He had a radio direction finder and immediately put it to work. He ordered the "Garnet Hulings" to send radio test signals every half hour; he would guide on them. On top of the navigation room is the wireless loop for locating the direction of signals. It was turned until they came loudest. The "Sadler's" radio loop told its skipper that the rockbound ship was not on Sombrero reef, but ten miles south of Gun Key, or 110 miles from her reported position.



On a Tanker's Deck after a Winter Storm; This Particular Craft Battled a Heavy Sea on the Way to Halifax in December

Nosing into the Waves with a Load on Deck and a Heavier One Below; Tightly Closed Hatches Are Highly Important in a Storm like This

The "Sadler's" chief engineer took charge of the engine room and piled on all possible steam. Like a thing alive, she leaped into the frothing combers until her deck was awash. Signals from the "Garnet Hulings" kept coming stronger and stronger. "Hurry! We're pounding hard! Hurry!"

At 4:00 a. m., the weather and sea began to moderate, and the "Sadler" forged into strong currents, setting north, and southeast wind. At 7:03 a. m., the vessel came abeam of the Gun Key light. At 8:15, she sighted the "Garnet Hulings," and began to crawl slowly over treacherous reefs, taking soundings frequently. Shortly after 9:12, the crew sounded nine fathoms and order was given to let go the starboard anchor.

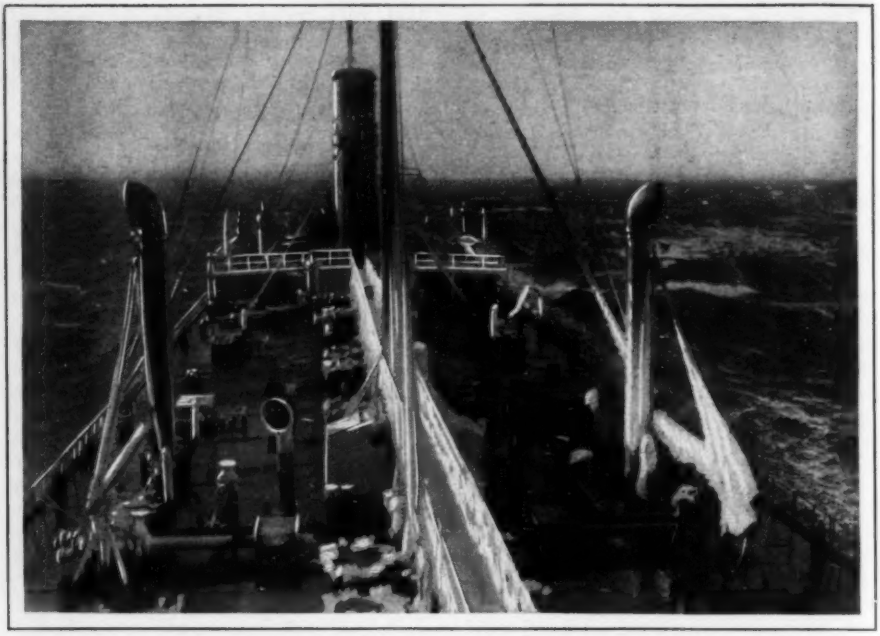
The "Sadler's" skipper launched the starboard lifeboat and ordered the crew to mark a channel. Although they pulled like madmen, the wind and current were so strong that after half an hour of exertion with double-banked oars, they had advanced only 200 feet. The skipper ordered them back. The "Garnet Hulings" had pumped the cargo out of two of her tanks; even this did not float her.

The "Garnet Hulings" launched one of her lifeboats with a small Lyle gun, which was attached to a running line aboard the "Sadler," whose skipper ordered both anchors payed out until 120 fathoms were out on the port chain and 105 on the starboard chain. At 3:30 the hawser was made fast and the "Sadler" started her engines. It pulled the "Garnet Hulings" off the reef and, with a toot of her whistle, the "Sadler" was on her way once more, off to Baton Rouge.

Capt. Thomas J. Gilroy, in charge of the Standard Oil company (New Jersey) fleet, tells how, on one of his thirteen crossings of the war zone in a tanker, his ship was torpedoed 185 miles west of the Straits of Gibraltar. It was the S. S. "Platuria." She had discharged a cargo of aviation naphtha and was returning to New York.

"We had been riding through heavy fog for some hours," said Captain Gilroy. "Suddenly, on coming into a clear patch, the lookout saw the foam of a torpedo.

"He cried out, of course. But it was



Remnants of the Icy Gale; Oil Will Smooth a Heavy Sea but Not When It Is Loaded inside the Tanker, Which Rests Low in the Water So That Waves Will Wash the Deck

too late. Before the helmsman could swing her around, we were struck amidships on the starboard side. She turned over on her beam ends immediately. We managed to shove over only one lifeboat. Those who couldn't climb in, jumped into the water.

"When the sub came to the surface, she picked up all the swimmers and carried them alongside a capsized lifeboat, which her crew righted. They set us all adrift in the two boats. Nine of our men were drowned.

"It was late in the afternoon when I ordered my men to hoist the sail. I set a course for Africa. I had a compass, but it was of little use. When darkness fell, I set a better course by keeping the North Star abeam. We sailed due east.

"There was little to see on the dark ocean that night. We were looking for ships, but there was small chance of finding one, because they hid their lights. Meanwhile, my men began to cry for water. Well, there was water in a sealed tank, but I held them off for a while, not knowing how long it would have to last. Toward daylight, they began to get real thirsty, so I ordered the tank opened. The odor of that water was so foul we had to throw it away.

"Just before noon, we saw a collier making for us. She turned out to be an Italian ship, and her skipper offered to take us into Norfolk, but we wanted to return to Gibraltar. Finally, we compromised, and he landed us on the island of Madeira, where we lived comfortably for a month, until another vessel picked us up."

SEISMOGRAPH PICKS BEST ROAD BY RECORDING VIBRATIONS

Seismographs, primarily designed to register earthquakes, now are being used in road building. In California seismographs have been placed along several highways to record the vibrations set up by passing trucks and automobiles, measuring simultaneously the extent of horizontal and vertical movements. The records are expected to prove helpful in showing the difference in service life of various kinds of roads.

METEORS MAY MENACE PLANES AND SHIPS

Meteors may be to blame for mysterious airplane accidents, forest fires, destruction of ships, and even bad weather, a French meteorologist has suggested. Red-hot meteors may set up electrical disturbances as they sizzle through space, such disturbances affecting both airplanes and ships. It has been calculated that a two-ounce meteor, the size of a hazelnut, would travel thirty miles a second as it nears the earth, and have the force of a 500-ton train. Meteors are so numerous as often to cause "bombardments," and may be responsible for accidents such as that which occurred recently in Budapest when a girl on her way to a wedding was killed by one. Airplanes, too, may be struck down and ships destroyed. A meteor also might possibly explain freak accidents like the recent destruction of a powder magazine without apparent cause.

Pictures Taken in One-Twentieth of Second with Powerful X-Ray, Which Is Shock-Proof for Operator and Patient

X-RAY SNAPSHOTS ARE TAKEN WITH POWERFUL TUBES

Taking a picture in only one-twentieth of a second, the most powerful shock-proof X-ray apparatus in the world recently was exhibited at the British Institute of Radiology. With it, interior pictures may be taken almost instantaneously without risk either to the subject or the operator.

SMALL PIPE ORGAN FOR HOME SHAPED LIKE GRAND PIANO

Intended for installation in private home or apartment, a pipe organ has been made which takes up no more space in the living or music room than the large grand piano which it resembles. The 231 pipes are contained within the case and the organ is mounted on casters so that it can be moved from one room to another.

Pipe Organ for the Home with Its Pipes Contained in a Case Resembling a Grand Piano

AUTOMATIC WINDOW SASH ENDS NEED FOR PULLEYS

Eliminating weights, cords and pulleys and the ordinary box frame, a window-sash holder now is on the market which operates on rubber rollers on an interlocking shoulder track set directly into the window frame. A sliding type also is provided for lightweight sash, and both kinds have weather strip attached to the track and are provided with adjusters, making it possible to regulate the tension without removing the sash. Use of the sash holder not only eliminates the usual cords and pulleys, but also enables a saving in construction costs, because box window frames are unnecessary, and the solid frame keeps out cold air and dirt that cannot be hindered effectively from filtering in around the box type.

Needles Dropping through Combinations of Holes in Perforated Rolls Weave Intricate Designs in Factory-Made Rugs

BEAUTY IS WOVEN INTO RUGS FROM PIANO-ROLL PATTERNS

Weaving of intricate and beautiful designs into machine-made rugs is accomplished by a complicated loom that fashions the patterns almost as exactly and artistically as the slow hand process employed abroad. Needles drop into various combinations of holes and thus control the patterns produced.

CHEESE PACKED IN VACUUM BOX RETAINS ITS MOISTURE

Vacuum containers for shipping cheese are undergoing tests in New Zealand after the system was found acceptable for packing butter. The container consists of two pieces of metal stamped to conform to the shape and size of the cheese. These pieces are fitted around the cheese and the contact edges soldered with a wire buried in the solder strip, one end of it protruding. Mechanical exhaustion of the air in the chamber and sealing of the exhaust portal complete the packing. Tests have shown that cheese so packed for fourteen months lost only one pound in weight, had no rind, kept its flavor and was well cured.

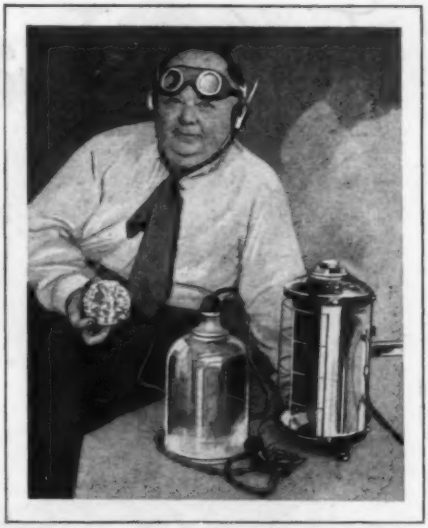
WEATHER SENSE OF ANIMALS DUE TO AIR PRESSURE?

That the mysterious tendency of many animals to sense approaching changes in the weather may be due to sudden variations in the air pressure as a result of atmospheric disturbances has been suggested by H. P. Lasher, weather and crop reporter of Cushing, Iowa. Mr. Lasher points out that, under normal conditions, a human being sustains an atmospheric pressure of approximately fourteen tons. Would any sudden fluctuation in this pressure react upon him in such a way as to cause him to become restless or to affect his appetite? A few individuals appear to be sensitive to weather changes, but animals possibly are more so, because they are not constantly sheltered under roofs and, hence, their "sixth sense" is more acute than it is in the case of human beings. Fowls, hogs and other domestic animals often manifest evidences of their "weather sense." Many farmers know that, when hogs begin lining their sleeping quarters with straw in the winter time, a storm is brewing. Mr. Lasher reported that his own records did indicate a relationship between pressure and another natural phenomenon, namely the flow of honey. He found that the greatest flow in northwestern Iowa, for instance, was during

periods of low pressure and high humidity. In that section of the country, the alfalfa bloom seldom yields nectar, he declares, although in the high altitudes near the Rocky mountains, it is considered one of the best honey yielders.

PLANES ARE TILTED ON END TO SAVE HANGAR SPACE

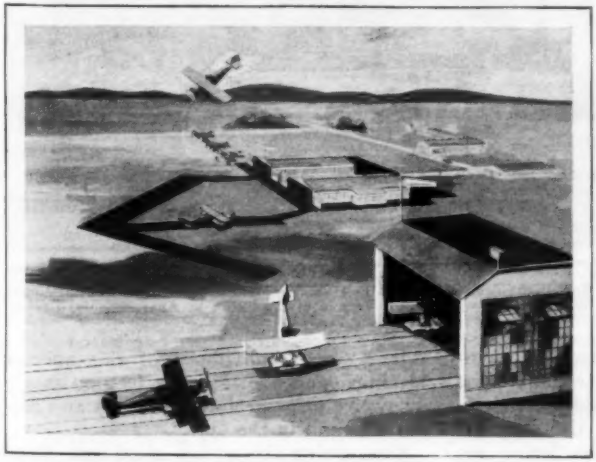
Storing airplanes in hangars and removing them is simplified by means of a system of small carriages that run on tracks and tip the planes at an angle so that more can be stored in one hangar than is possible by the usual method. The ship is taxied up until its wheels rest in grooved holders on each side of the carriage. By turning the crank of a cog wheel at the front, the ship is tilted and comes to rest at an angle of approximately thirty degrees. The plane and carriage are then pushed into the hangar. Only one man is required to take care of the planes with this device, and the hangar can be designed so that less room is wasted on the airport site. The system also eliminates the necessity of pushing several planes out of the hangar when one is desired, reduces the number of men needed at the station and helps protect the planes, as they are less likely to be damaged in getting them in and out of the hangar.



Crystallized Salt Removed from Chemically Treated Sea Water to Make It Available for Irrigation

SEA WATER USED TO IRRIGATE BY CRYSTALLIZING SALT

Sea water, chemically treated to remove its salt, is proposed by a Los Angeles agronomist as the solution of southern California's irrigation problem. At first plans were made to treat sea water in such a way as to obtain the valuable fertilizing minerals and substances it contains, but during experiments it was found possible to utilize these substances without removing them from the water by crystallizing the salt held in solution in the sea water. Instead of allowing the salt to crystallize in particles of dirt to form a crust handicapping growth, it was found it could be made to crystallize before reaching the soil by running high-frequency current through the water and at the same time treating it with ultraviolet and cathode rays. Laboratory tests of this method have been satisfactory.



Airplanes Taxi onto a Track Which Elevates Them at an Angle Before They Are Pushed into This Hangar, Thus Saving Space

In the Land of the

Photo Ewing Galloway

Top, Eight-Year-Old Ceylon Boy Learning to Charm a Cobra as His Mother Watches; Below, Ruins of Temple of the Tooth at Anaradhapura, Ceylon, Dating Back to 300 B. C.

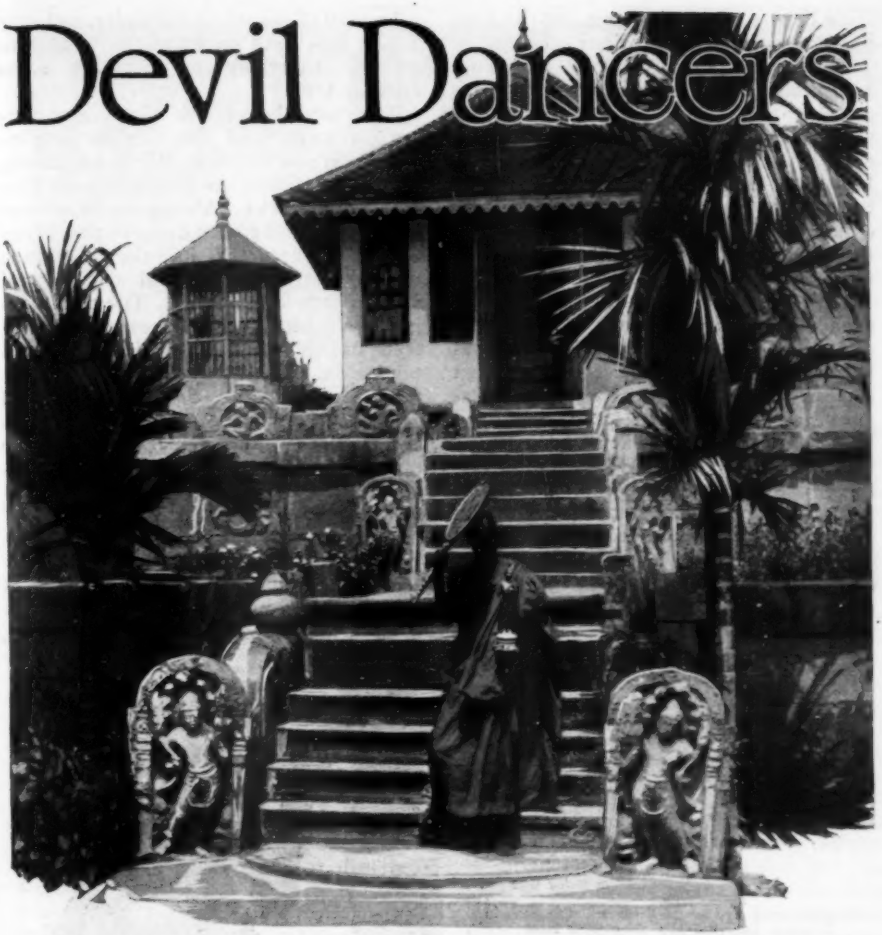
STRANGE adventures befell Dr. Casey A. Wood, famous naturalist, during a two-year study of the wildest jungle region in Ceylon, mysterious pear-shaped island off the coast of India.

Doctor Wood found an immense artificial lake, covering more than a hundred square miles, built probably five centuries ago, and thickly infested with man-eating crocodiles, outlaw elephants that turn bandits and slayers, wild water buffaloes that attack man on the slightest provocation, ferocious marsh bears, vicious little land leeches, queer "tailor" birds that sew and stitch with almost human skill, "architect" ants that build a remarkable type of living structure, and weird devil dancers.

In the course of his thrilling experiences, Doctor Wood was accompanied only by native guides when he stumbled upon the great artificial lake which he refers to as the "Giant's Tank." "It was an irrigation reservoir," he says. "I spent several days studying its marvelous construction and found it to be crowded with thousands of crocodiles. Some individuals of this species attain a length of sixteen feet or more. They live on waterfowl, tortoises and fish that abound in the lake."

Concerning the outlaw elephants, Doctor Wood points out: "Writers devote

Devil Dancers



Buddhist Priest Bearing Image and Screen at Entrance of Isuruminigo Temple in Ceylon; Note the Semi-circular Carved Stones Marking the Entrance to All Religious Buildings in Ceylon

much space to the 'rogue,' or Singhalese 'hora,' and it certainly is a pitiful and picturesque figure. Nearly always it is a male, who, an outcast from its herd, owing to some breach of jungle law, is not allowed to join any other group, and becomes a veritable Ishmaelite. It may drink, bathe and eat in the vicinity of a herd but any attempt at familiarity or intimacy with any of its members is at once resented, and the intruder is driven off, the process being punctuated by heavy blows with the trunk and butting with the head, administered, it may be, by previous friends and companions of the outcast.

"No wonder this otherwise gentle and social animal becomes savage, morose and dangerous under such treatment. He turns bandit and killer, spends his nights in destroying plantations, overturning huts and pulling up rice plants and young coconut palms. Hiding in the jungle by day, these crazed beasts often prowl about unfrequented roads and jungle paths, and it is extremely dangerous for an unarmed man to approach their haunt. Instances where they have killed innocent natives have caused government authorities to

issue licenses, free of charge, for the slaying of particularly notorious offenders.

"Unlike the India elephant, the Singhalese variety does not depend upon his trunk or tusks as weapons of defense, although he may occasionally use them for that purpose. Butting with his ponderous head and utilizing the enormous crushing force of all four legs, he holds the smaller animal with his trunk while he endeavors to tread the life out of it by alternate tramplings with his enormous feet.

"Just as few persons have ever seen a dead mule, so infrequently has the body of a dead elephant been found in the Singhalese forests. The natives believe that elephants bury their dead much like humans, and some assert that when an aged beast senses the approach of death, he sets out for a remote and quiet valley and there patiently awaits his end. I know of a certain forest near Anaradhapura that conceals one of these reputed elephant cemeteries, but so well hidden is it that no man knows its exact location."

Tame elephants have a wide variety of uses in Ceylon, Doctor Wood explains. They clear forest lands, work in brickyards, carry and pile timber, stone and other heavy material, draw wagons, cultivate the land, are regular adjuncts to the entourage of noblemen and serve as ceremonial animals at holy temples.

Photo Ewing Galloway

A Good-Natured Peddler of Birds and Chickens in Colombo Carrying His Shop with Him

Wild water buffaloes are not particularly ferocious-looking, the naturalist points out. They delight in reposing for hours covered with mud while the helpful crow picks from their smooth, leathery backs the ticks that burrow into their skin. However, the Singhalese variety hates the very smell of the stranger, especially of the white outlander, and may attack him head on unless he is able to escape, preferably by climbing some friendly tree.

The marsh bear is one of the most dangerous animals of the Ceylon jungles, Doctor Wood believes. When frightened, it never hesitates to attack anyone that crosses its tracks. Always it attempts to bite and claw the head of its victim. Many a time the naturalist had the misfortune of acquiring a substantial covering of vicious little land leeches. The chief danger of the bites from the several hundred teeth of this creature is the infections and ulcers that follow.

The maneuvers of the tailor bird aroused Doctor Wood's amazement. Probably the most remarkable example of sewing and stitching noted by the naturalist was a nest mass made of four hibiscus leaves, about six and one-half inches long. It was built about four feet from the ground and was entirely hidden from view. The body of the nest was filled with a curious floss, mixed with vegetable fibers, a few hairs and a papyruslike bark. The nest cavity extended to the bottom of the structure and was carefully lined with floss over an intertwining layer of fibrous material.

Hardly less interesting were the naturalist's frequent encounters with the work of the architect ant. Red in color, it does not sew, but instead glues, the edges of

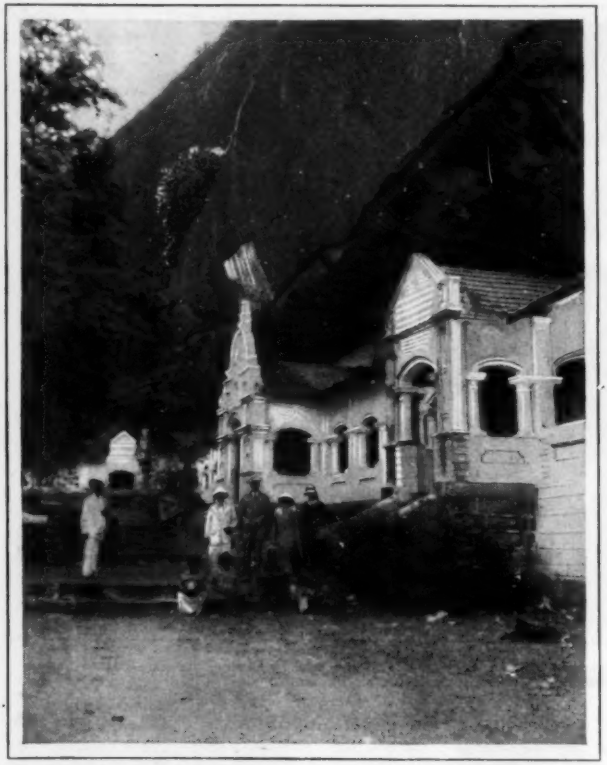
Elephants Are Used in Many Ceremonial Parades of Religious Significance in Ceylon, and the Picture Shows Such a Scene with the Pachyderms Bedecked as for an American Circus

leaves together, afterward lining its nest cavity, not with cotton or other fiber, but with a kind of self-made transparent paper which is also used for joining leaf edges.

"Many a time," explains Doctor Wood, "I have watched these industrious architects at work. The object of this house building is to form a globular casing in which food and breeding cells may be stored. First, several ants stand on the margin of one leaf, grasping the edge of another leaf in their mandibles. Next they draw this to the border on which they are standing, while meantime other highly specialized experts paste the approximated margins together.

"If the neighboring leaf is too far away, the factory workers make a chain of their bodies to reach the desired contiguous blade, which is then drawn up and cemented. This work is so thoroughly done that, long after the leafy materials have dried and are partly disintegrated, the original structure holds its shape and a good deal of force is required to tear it apart."

In certain obscure jungle regions the naturalist came upon elaborate ceremonies performed, under the direction of holy men of the Singhalese tribe, by individuals known as devil dancers. The procedure usually employed is as follows: First of all, the victim appears, presumably to be relieved of the devils that have entered his body and caused some sort of ailment or disease. Now the band strikes up, composed of tom-toms, reeds, viols, cymbals and crude pipes. This is a sort of overture to the main series of dance movements. It is symbolic of the affliction of the person being treated. Assuming that he has a certain disease, all his expressions of pain and agony are simulated by the various sounds of the instruments. Next the dancers, known as the "Natun Karayo," band together into a large charmed circle, so called because it has been blessed previously by the sacred men of the tribe. Their dress is fantastic and fearsome—they wear short skirts that are accordion-pleated and of brightest colors. Some wear hideous masks and



Cave Temple at Dambulla Where a King Withstood a Thirteen Months' Siege About 100 B. C., and Out of Gratitude Transformed the Cavern into a Memorial Temple

charms made of wild blossoms; others, instead of masks, have their faces painted in red and white, while still others wear the skins of the leopard, cheetah, jaguar and jackal.

Probably the most impressive part of the entire ceremony is the occasion, well on in the dance, when the high priests commence to chant a series of loud supplications, demands and exhortations. Usually the holy men stand in the center of the charmed circle while the dancers and spectators watch and listen with genuine apprehension. Incense offerings are presented to the native gods by burning various strong scents in jars or braziers.

The length of the dance depends upon whether the priests have been able to persuade the evil spirits to remove their presence from the body of the afflicted person. When they are so persuaded, the dance proper is said to be officially over, the victim falls prostrate, and tells the priest that he is clean again, whereupon all the natives eat betel root or drink large quantities of crudely made liquors.

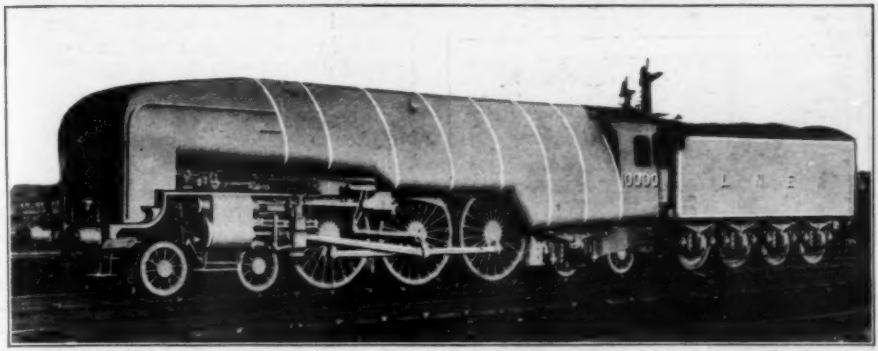
Ceylon is filled with the ruins of temples, palaces and great cities, but its glory is now but a memory of a long departed splendor.

STEAM SHOVELS SALVAGE OIL

Steam shovels are digging oil in the famous Yates field in Pecos county, Texas, where more than 1,000,000 barrels of seepage have been recovered by this and other processes. The big 1,000 to 1,600-foot wells were found to be leaking oil from around the casing, the seepage passing into a bed of coarse gravel that leads to the Pecos river. The oil was first noticed in a water well and later it was seen running into the river. The company owning the river-bed lease placed a wooden boom across the river and turned the oil into ditches from which it was pumped to tanks, thus recovering nearly 200,000 barrels. The steam shovels were used by another company to dig a trench thirty feet deep, the oil soon filling the space. Small pumps were placed at the end of the ditch and more than 650,000 barrels were thus recovered. A number of shallow wells were also sunk to the gravel stratum and small pumps erected over them.

¶Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and will be furnished, free, upon application to our Bureau of Information.

"HUSH-HUSH" LOCOMOTIVE HAS STREAMLINE BOILER



Great Britain's Newest High-Speed Locomotive with Streamlined Boiler; It Was Called the "Hush-Hush" Engine Because of the Secrecy Which Surrounded Its Construction

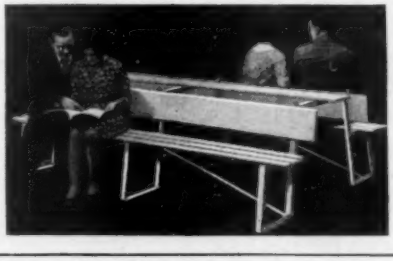
England's latest high-speed locomotive, embodying many novel principles of boiler design, including a streamline effect, recently made its first public appearance and attracted widespread attention among railroad officials. It is known as the "hush-hush" engine because of the secrecy surrounding its construction.

GEARS MADE FROM CORNSTALKS GIVE LONG WEAR

Seven gear wheels manufactured from cornstalks have been in service for more than two years at the Iowa State College and show practically no signs of wear. The material is but one of the many useful forms that cornstalks and corncobs are taking under methods developed by Dr. O. R. Sweeney and associates. A substitute for teakwood which is sixty per cent stronger than the natural wood is being manufactured after the stalks are beaten and ground into a substance that quivers like jelly before it is dried. Airplane propellers can be made from the synthetic wood, and cornstalks also have been used in a material that serves as a substitute for tile floors. It is quickly applied and becomes hard in a few hours. Markings are placed in it to resemble the spaces between tiles. From the pith of the stalks, a material that is lighter than balsa wood is being prepared. It has insulating and acoustic properties that make it suitable for many applications. The cornstalk product can be made in almost any size, while natural balsa wood is obtainable only in comparatively small pieces, as the trees do not grow large. A substitute for cork is also being manufactured from cornstalks.

PARK BENCH MADE INTO TABLE BY FOLDING BACK RESTS

Combining two benches and a table into one piece of equipment, a novel type of park furniture now is available. Two long benches are fastened back to back by crosspieces, and by lifting up and folding over the back supports, a substantial picnic table is made with the benches already in position, thus saving the assembling of heavier benches and tables. Single-seat benches also are similarly designed, the back folding to rest on two supports which, with the bench itself, hold the back as a table top.



Double Park Bench Which Is Converted into Picnic Table by Folding Over the Back Rests

ELECTRIC PURIFIER FOR WATER WORKS FROM SOCKET

Electricity Is Employed in This Apparatus to Purify Water, the Current Killing Injurious Germs

Purifying water by electricity is done in an improved manner in a compact unit operated from the lighting circuit. As the water passes through various chambers in the purifier, it is subjected to the action of electrical currents which remove foreign particles of matter and also kill injurious germs. The supply becomes more pure as it passes through the chambers until it is finally delivered in a state equal to that of distilled water. The apparatus requires practically no attention once it is installed; the chambers are kept washed free of accumulations by the flow of the water under treatment, and great efficiency is claimed since there is no necessity for heating with the consequent loss by evaporation and radiation.

FEWER SUNSPOTS GIVE PROMISE OF BETTER RADIO RECEPTION

According to Dr. Harlan T. Stetson, of Ohio Wesleyan University, 1930 should be a good year for the radio lover, because better reception is probable with the decreasing number of spots on the sun. As the year waxes, the number of spots is expected to wane, resulting in a corresponding increase in radio-signal strength in the broadcast zone. Reception last year followed the fifteen-month cycle observed in the sunspot numbers with a marked depreciation during the fall maximum, when, under normal conditions, radio reception should have been improving with the decreasing hours of sunshine. With the development of the radio, scientists have been afforded a valuable new tool with which to study solar radiation and other phenomena. Apparatus has been devised for the automatic registering of radio-signal strength at all times of the year, so that the connection between the clarity and strength of the signals and the condition of the sun, can be more accurately determined.

STREET-LIGHT SERVICE TRUCK HAS EXTENSION PLATFORM

Easy access to street lights by workmen cleaning or replacing globes and bulbs is afforded by an extension platform mounted on a service truck. The ladder is curved in such manner that the platform stands beside the street light at the proper height for workmen when the truck is parked at the curb.

Extension Platform on a Street-Light Service Truck Gives Easy Access for the Repair Crew

Thrills of Riding Wild Horses without the Attendant Danger Are Furnished with This "Buckaroo," the Saddle with Four Ropes Attached, Each Being Tugged in a Different Direction

BUCKING BRONCHO IS IMITATED WITH SADDLE AND ROPES

Greenhorns on a "dude" ranch in Montana who aspire to ride bucking bronchos are given their first taste of such sensations on the "buckaroo," which provides most of the thrills of a wild cow pony without much of the danger. The buckaroo is a saddle to which are attached ropes extending to the four points of the compass, each rope being secured to a tree. With the would-be cowboy or cowgirl in the saddle, four men begin tugging at each of the four ropes and the tossing and pitching dude tries to hold his seat.

SCIENCE SEEKING "SUPER-CORN" TO INCREASE YIELD

Within ten years, scientists hope to develop a variety of corn which will have a stiffer stalk, a more uniform ear and a stronger shank. It may result in so much larger production that it will be possible for farmers in the corn belt to raise on 40,000,000 acres of land as much as they now produce on 50,000,000 acres, according to experts who appeared before the recent meeting of the American Association for the Advancement of Science. The 10,000,000 acres of land so released could be employed for other purposes and a saving of 15,000,000 hours in man labor would be brought about.

SOFT CUSHION FOR AUTO FLOOR PROTECTS HIGH HEELS

For the woman auto driver, a mat of wool fur with rubber base now is on the market for the floor of the car, to protect high heels and dress shoes from becoming chafed or soiled while driving. The mat relieves foot fatigue, protects fine shoes and prevents wear on the floor covering.

¶ More than one hundred chemicals enter into the manufacture of an automobile.

The Race to Explore

Photos Courtesy UFA Films

Reaching for the Moon; Striking Photograph of Rocket Scene from German Film, "The Woman in the Moon," an Unusually Interesting Story in View of Recent Attempts to Probe Higher Altitudes

By MILTON FAIRMAN

MAN'S valiant struggle to conquer his universe seems now on the eve of another epic victory. In preparation for the morrow's conflict, two scientists are assembling their armaments. Their laboratories are 4,000 miles apart. An ocean lies between them, but their aspirations are the same—the conquest of space.

If this were not the age of the seemingly impossible, their hopes might seem absurd. This is, however, the century in which the thousands who scoffed at the Wrights and Marconi are soaring through the clouds while radio brings them news of the cities below.

Thus the plans of Prof. Robert H. Goddard, of Clark University, and the German scientist Herman Oberth are being received with higher regard than were the first pronouncements of Doctor Goddard some twenty years ago. The scientific world is becoming rocket-conscious. The poles have been covered, the skies saddled, the mountains penetrated by engineers, nature's submarine secrets have been disclosed to the camera. Why not probe the interplanetary spaces?

The first steps already have been taken. Rockets have been developed with aerial exploration in view by both Doctor Oberth and Professor Goddard, and Fritz von Opel's experiments with rocket cars and planes have met with gratifying success. Perhaps it is an exaggeration to talk of reaching the moon. Neither of the leading experimenters have any immediate hopes of doing so. But their preliminary tests have led them to make sanguine prophecies. Some day, the American asserts, man may send a rocket across those 221,614 miles to the moon. Before that, his German colleague believes, rockets may be speeding across the Atlantic bearing mail. Within four years, he asserts, there may be passenger rockets. The soundness of the efforts to send such projectiles to explore the space above us has been endorsed by the Smithsonian Institution, Clark University and the French Academy of Science.

Outer Space

The inhabitants of Worcester, Mass., became aware of the rocket last summer when they were aroused one night by a terrific blast. The next morning the whole country knew that Doctor Goddard had sent his projectile hurtling from the experimental field with success.

A working model—a projectile nine feet long and two and one-half feet in diameter, sheathed in aluminum—had flashed up the sixty-foot shaft skyward with incredible speed. The performance convinced the scientists who witnessed it that a larger mechanism might successfully explore the unknown air regions above the earth.

Professor Goddard hopes shortly to make another attempt. This time it will be a twelve-foot rocket, propelled by the liquid used as fuel in the last experiment. Apparatus for sounding the higher regions will be sent

Close View of the Moon Set Constructed for the Movie and a Lunar Valley in the UFA Film

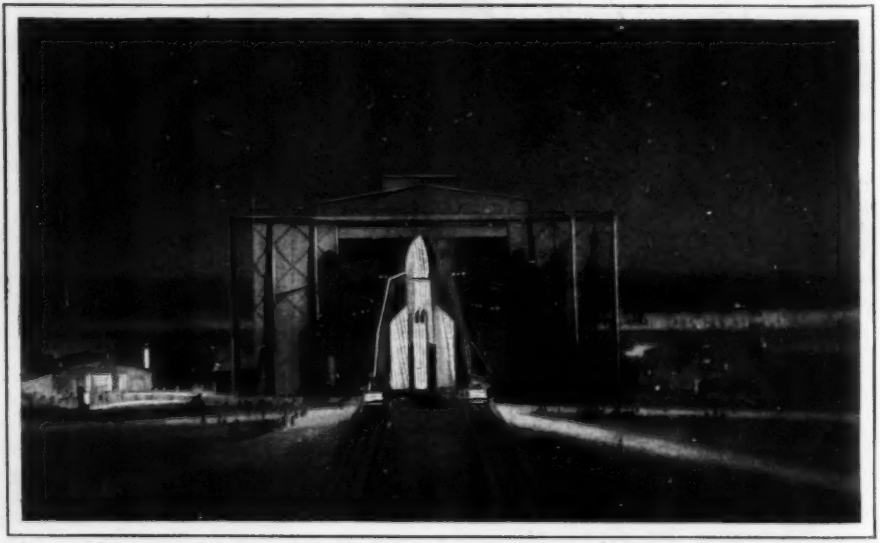
with it and may bring back startling results. In the June test, a camera, a barometer and the mechanism came down to earth by parachute uninjured.

In the meantime, Doctor Oberth is continuing his experiments. In the near future, a rocket, thirty-two feet in length, will speed heavenward, according to his plans. It will be propelled by liquid oxygen and hydrogen and guided by two rudders and two stabilizing vanes. A parachute with scientific recording apparatus will be installed in its nose to be released when the rocket reaches its expected height—somewhere around thirty miles—in about a minute after it is launched. The test will be made at Greifswalder Oie, an island off the Baltic coast, and the projectile will fall into the sea.

Such are the results of recent experiments with sky-directed rockets, and the plans of the inventors for the immediate future. Strangely enough, man knows but little of what lies between him and the stars. Some knowledge has been obtained of the atmosphere directly above for some twenty miles. No man has ascended that high, but free balloons, without occupants, have risen to that height and their instruments have brought back meager records of atmospheric and climatic conditions. The sponsors of the rocket hope not to joyride to the moon, but to obtain new information on this hitherto unexplored area that aviators and agriculturists alike may profit.

Many sneered when Dr. Albert Neuberger hailed the rocket as the "supreme effort to release man from earth's gravitation." For the question of gravitation is one of the foremost considerations in contemplating lunar flights. A speed of seven miles a second is estimated to be necessary to carry the rocket past that point where earth's gravitation exerts the least pull—about 200,000 miles away. When black powder was used, Doctor Goddard foresaw that it would take 1,000 pounds of fuel to send a weight of one pound completely away from the earth. A liquefied mixture of hydrogen and oxygen worked so successfully that he found it would be possible to propel the same weight with a fuel expenditure of only 43.5 pounds.

It is obvious, of course, that consumption of fuel lessens the weight. A further step to reduce initial weight was the development of the multiple rocket. This is a series of projectiles overlapping one another in sheaths. When one rocket burns out, its shell drops off, relieving the



Pulling Rocket Out of Its Hangar for the Journey to the Moon, a Scene from the Spectacular German Film Which Blends Fancy and Scientific Data

Fritz Lang Staging a Camp Scene in the Moon Valley; the Film Gave Lighting and Other Technicians Unusual Opportunities to Develop Novel Effects

main projectile of its dead load and thus increasing the speed.

Another obstacle raised by the skeptics is that a rocket cannot operate in the vacuum above the earth. This objection was based on the fallacy that the missile is forced upward by its ejected gases impinging upon the air as a cushion and thrusting the projectile upward. What propels the rocket is, however, the explosion of the fuel against an inner steel chamber forcing it ahead in the direction desired. In fact, tests have shown the rocket operates with an improved efficiency of twenty per cent in a vacuum.

Would the terrific speed at which rockets travel generate sufficient heat to destroy a moon-bound projectile? Doctor Oberth says it would not, and he suggests a jet of water from the nose of the projectile to cool it. In a vacuum, heat would, of course, be obviated.

Doctor Oberth's belief that eventually man will find the rocket a convenient and safe form of transportation has aroused much skepticism. Could a human being survive the speed of the rocket? The scientific opinion is that he could, providing the speed was gradually attained, the passenger protected from friction and pressure, and the stop a gradual one. The speed alone, it is explained, will not affect the passenger.

In the meantime, experiments with rockets, not bound for the moon but into that mysterious region just twenty miles above us, continue. Man may thus be on the brink of some new stupendous adventure. The future of his knowledge of the world above rests largely with the results of the two experiments scheduled for the next few months.

TIRES PAINTED TO MATCH AUTO

Tires in Great Britain are being painted to match the finish of the car, a full range of colors with a rubber base having been placed on the market for that purpose. It is claimed the paint has a preservative effect on the tires, and that it will not wash off.

CHECKERED COAT FOR WORKER GUARDS AGAINST ACCIDENTS

Checkered Coat Worn by Railroad Worker for Safety; for Night Work It Contains a Light

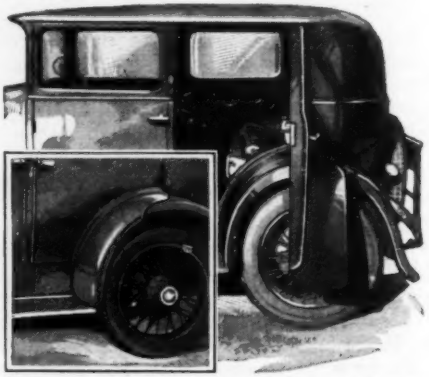
Rail greasers and other workers on the street railways in New York city are wearing black and white checkered coats and caps with a bright red band so that they will be plainly visible at dangerous places. On the back of the coat is a strap which supports a searchlight at night to afford additional protection after darkness. The lamp is supplied with current from a battery in the worker's pocket.

EVEN SPEED BEST IN LONG RACE FATIGUE TESTS SHOW

A few years ago, foot racers thought that a sprint at the start of a long race and, if possible, a burst of speed at the finish, would produce the best record. Science has been at work for the benefit of the athlete and has upset many old traditions while revealing important facts with relation to the human machine and its tendency to become fatigued. Many tests have shown that a nearly even rate of speed is best for the long-distance runner. A series of experiments and measurements made by Prof. Arthur E. Kennelly, of Harvard University, have established that the laws of racing fatigue are substantially the same for men and horses, with horses in any of three gaits and men in any of five. When distances are doubled, about 118 per cent more time is required. Increasing the distance sixty-fold increases the time required a hundredfold, it was found. Nurmi is a remarkable runner not only because of his speed and endurance but because he established records in several different distances, something that few runners have been able to do, and this is explained partly by the fact that he has acquired a guiding sense as to the best speed to adopt for each particular distance and keeps careful check of his time throughout a long race. The tests revealed that horses are more precise racers than men. Athletes exhibit the greatest precision in walking, and next in swimming. The least precision is maintained in skating. In automobile races, the speed is practically constant, but in distances beyond 400 kilometers, some variation may be due to fatigue in the driver.

FENDER WING ON DOOR OF AUTO KEEPS CLOTHES CLEAN

Protecting the clothing from dirt splashed over the rear fender of the automobile is the purpose of a wing which attaches to the rear door of the car and operates with it. When the door is opened, the soiled fender flap moves back, exposing a clean section against which the clothes may brush unharmed.



Fender Wing, Attached to Door of Auto and Opening with It, Protects Clothing from Being Soiled

Thrills in Search for Sun's Secrets

Observation Station on Mount Brukkaros in Southwest Africa, and Some of the Instruments Scientists Used in Making Observations of Sun Radiations during a Three-Year Period

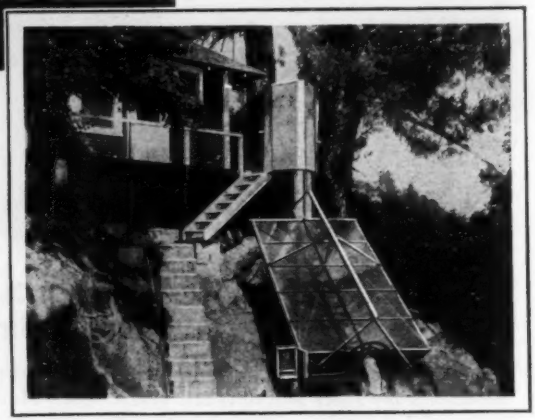
By JOHN L. COONTZ

PERCHED on top of a sun-baked mountain for three and one-half years, surrounded by deadly cobras and stalked by leopards; such was the fate of W. A. Hoover, Smithsonian scientist, who has just returned from South Africa, where he made solar radiation observations for the institution.

Mr. Hoover did his time on Mount Brukkaros, about 1,000 miles from Capetown, in the heart of the Hottentot country, some eight miles from the nearest white man and sixty miles from the nearest settlement. His home was a wooden three-room structure covered with galvanized-iron sheets; his companions, his wife and baby, an assistant scientist, a cow and a few chickens.

"We'd open a door and push a cobra out of the way as a part of our morning routine," he declared, "and the leopards would come around, attracted by the chickens which they hoped to feast on." Mr. Hoover had the unique experience of having a cobra spit deadly poison in his face. Fortunately the poison struck him on the cheek and did not touch his eyes, or he would have been blinded.

The ringhals cobra, native to the section where the solar observatory was established, shoots its poison at its intended victims as well as injecting it by contact through a bite. The powerful muscles controlling the poison glands of the snake are capable of projecting the destroying fluid a distance of six feet or more. Mr. Hoover, at the time he was attacked, was entering his storehouse. It was dark as he entered and he felt moisture suddenly on his cheek, as from a light spray. He sensed immediately what had taken place and lost no time in swabbing his face with his handkerchief, being careful to protect his eyes. His fright over, he retired, got



Above, Pyrheliometer to Measure Heat of Sun's Rays; Below, Sun Cooker Made by the Scientists

a light and his gun and put an end to the snake.

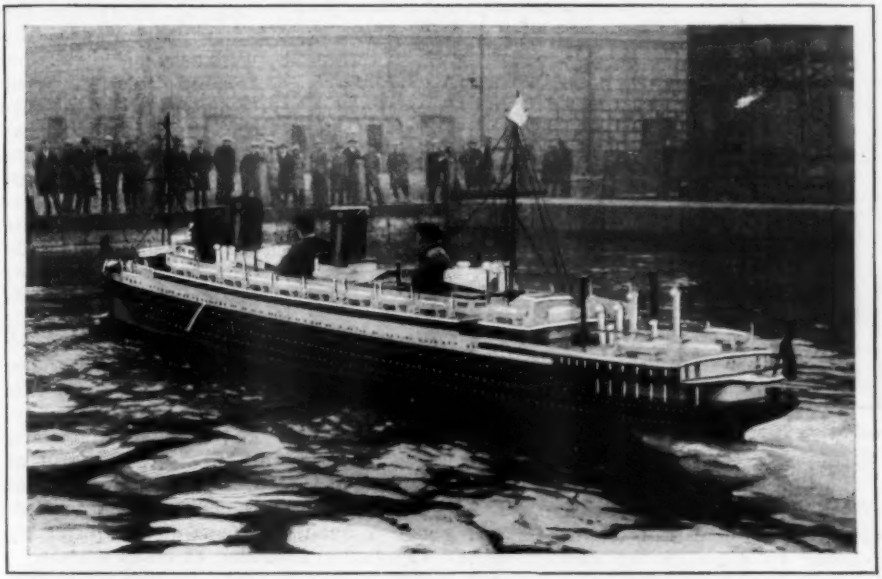
The honor of bagging the first leopard ever to be killed with a .22 rifle belongs, perhaps, to Mr. Hoover and his assistant, Fred A. Greely. Hearing a noise that sounded like a lion one night and, the next morning missing three chickens, the two set out to track the marauder. Fortunately the robber was no more than a leopard which they soon cornered. It put up a fight, and charged, but rough ground was in their favor and after two or three shots they came off victorious.

Although cast in this isolated spot, Mr. and Mrs. Hoover and their companion were not without some of the comforts and conveniences of civilization. The first Christmas they were on the mountain the National Geographic society, whose grant of funds to the Smithsonian made possible the establishment of the observatory, gave them a radio. This made possible entertainment from the outside world during their leisure moments. A pressure oilstove gave them almost the service of a gas range and, with the advent of the "insides" of an electrical refrigerator, they managed to make for themselves an "iceless refrigerator." This gave them ice cream in season—which was all the time—and enabled them to keep their food supplies in good condition.

The Hottentots, among whom the scientists lived, are not savage in the popular sense of the word as applied to African tribes. Many of them are Christians and nearly all affect the white man's dress, usually cast-off garments of nondescript character. Because they have never made war on the white man, these Hottentots enjoy a certain degree of local government, which is administered by the "captain" of the tribe. The heat on Mount Brukkaros maintains a high average the year round. Rainfall throughout the region is not great—one of the reasons why the spot was chosen for radiation-observation work. There is no shade on the mountain and 100 degrees Fahrenheit is not unusual for months at a time. This "free" atmospheric condition makes possible an almost steady beat of the sun rays on the earth's surface.

Astronomical study of the sun and the compilation of a complete daily record of its radiation with a view to forecasting weather for long periods in advance, are the scientific aims of three solar observatories in different parts of the world.

LINER MODEL STEAMS THROUGH CROWDED HARBOR

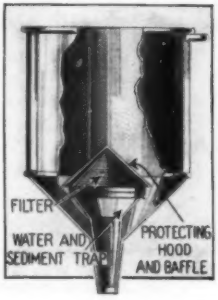


Thirty-Nine-Foot Working Model of the Liner "Columbus," Whose Twin Motors Can Carry a Crew of Four Among the Ocean Liners in New York Harbor at a Speed of Eight Knots

Capable of making a speed of eight knots, a thirty-nine-foot working model of the North German Lloyd liner "Columbus" attracts much attention as it proceeds around the breakwater at the Battery in New York harbor. It is equipped with twin motors and twin screws, has a displacement of five tons, and carries a crew of four men, who occupy the curious position of being above and below deck at the same time.

FILTER FUNNEL FOR GASOLINE STRAINS OUT WATER

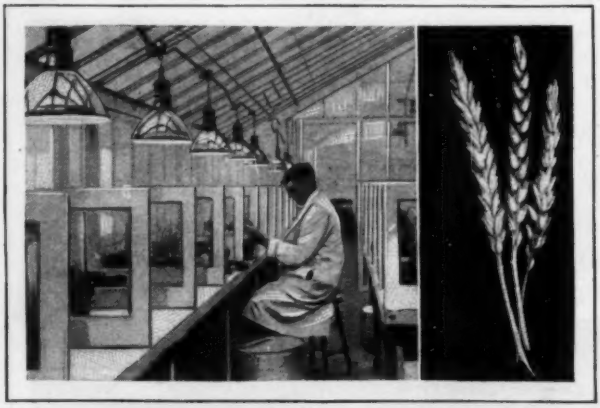
Water and sediment in gasoline are strained out without impeding the flow of the gasoline itself with a filtering funnel now on the market. The funnel replaces the slow method of straining through a chamois skin. The filter consists of a funnel through the bottom of which protrudes a second funnel at the top of which is a protecting hood and a cone-shaped wire filter. Water and sediment are diverted into the trap formed by the lower section of the larger funnel, the gasoline proceeding through the wire filter into the inner funnel. The cone-shaped hood acts as a protection for the screen, a baffle plate and an anti-splash device and proves effective in breaking up the particles of water. It is particularly suited for fueling airplanes where gasoline with any water content may have serious results.



LAYING DRAIN TILE MADE EASY

Laying drainage tile in irrigated lands is simplified in California by first going over the field with a mole drainer drawn by a tractor, which then pulls a string of tile into position. The tile sections are threaded on a rope, at the end of which is a plate to hold the last tile. With such an arrangement, it is possible to haul a string 200 feet long in one operation, saving much time and labor.

CONQUERING RED TERROR OF THE WHEAT FIELDS

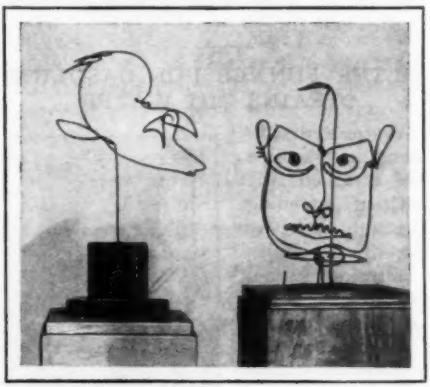


Laboratory Experiments in Crossing Wheat to Resist Rust, and Specimens of Rust-Proof Wheat That Were Thus Developed

One of the most radical developments of recent agricultural research has been the discovery of rustless wheats. It is impossible to estimate the damage done by rust, but some idea of its proportions may be gained from the fact that, in 1927, it exceeded half a billion dollars in North America alone. What, then, is rust? The farmer knows it as the red-colored powder which covers the leaves and stems of wheat plants and transforms the promise of a fine crop into a wizened harvest. The expert knows it as a microscopic plant, closely related to such commonly known fungi as mushrooms and toadstools. Early experiments led them to believe that sulphur could be employed as a fungicide, but "dusting" proved only a makeshift. Rain washed off the protective armor; high winds, prevalent on the plains, prevented the dust from settling with the desired uniformity. These and other considerations convinced the experts that the real remedy is in a rustless wheat. On the one hand there are more than one thousand bread wheats, none of them immune to rust. On the other hand there are members of the wheat family which are rust-proof, but none of them will make a good loaf of bread. The plant breeders at Minnesota University and at the Canadian Rust Research Laboratory endeavored to so cross these wheats as to produce a bread wheat with all the rust-resisting power of the other members of the wheat family. The amount of work involved is illustrated by the fact that the Winnipeg experts tested 150,000 separate plants in six months. One of the most successful rust-resistant wheats is the result of a fertile cross between Emmer and Marquis made by E. S. McFadden, a scientific farmer at Webster, N. Dak. For five years Dr. C. H. Golden, of the Winnipeg laboratory, and his staff of experts crossed plants and at present have eighty-six pure rust-resistant strains, twelve of which are equal to Marquis in quality, and one of them definitely superior to that king of bread wheats.

WIRE AND WOOD SCULPTURES RESEMBLE CARICATURES

Resembling somewhat in outline the caricatures of cartoonists, famous figures are sculptured in wire and wood by Alexander Calder. Instead of cutting the figures from stone, he twists a likeness from wire and mounts it on a wooden base. Among the models is one of the head of former President Coolidge.



Two Examples of Wire Sculpture, the Figure at the Left Being of Former President Coolidge

England's Entry in Ocean Race

Artist's Conception of the "Britannic," Weighing 27,840 Tons and 680 Feet in Length; Note Design of the Hull to Cut Wind Resistance and the Stubby Racing-Type Funnels

ENGLAND'S entry in the great race for commercial supremacy on the Atlantic will be a 27,840-ton super-motorship, the "Britannic," to make her maiden trip this spring.

The liner is built to contours that offer least resistance to wind and water. She will have racing-type funnels, which give the appearance of sleekness and speed, and add a greyhound's grace to a man-made ship.

The new Atlantic challenger has an over-all length of 680 feet, which is considered very great for a motorship. Some notion of the stupendous electrical energy to be developed by her four Diesel-driven generators may be gathered by noting that this floating steel shell could anchor beside an ordinary city of 30,000 people and produce enough current to keep it running comfortably.

With enormous power in her engines, it is no wonder that practically all work aboard this super-ship can be performed by electricity. An installation of 200 separate motors will peel potatoes, wash dishes, operate elevators, gears, pumps, steering apparatus and freeze ice cream, bake bread, drive printing presses and provide moving-picture entertainment. Two hundred miles of electric wiring will interconnect every room and compartment.

To keep the power plants from overheating, 13,000 tons of fresh water will circulate through jackets and cylinder covers, while 16,000 tons of sea water will pass through the lubricating-oil cooler and exhaust manifold before being discharged outboard.

The difference between these engines and that of the ordinary motor car lies in the method of firing the charge. In the automobile, a magneto fires the explosive mixture of gasoline. In the case of the "Britannic's" engines, the compression of each cylinder will be sufficient to ignite the vaporized crude oil. In the ordinary automobile, motive power is de-

veloped from the top side of each piston, while the "double-acting" motors in the "Britannic" will obtain power from both the bottom and top of each cylinder. The space occupied by her mammoth twin engines is equivalent to a garage large enough to park twelve seven-passenger limousines. Simply removing an exhaust or inlet valve, an engineer can climb bodily into each cylinder and inspect it.

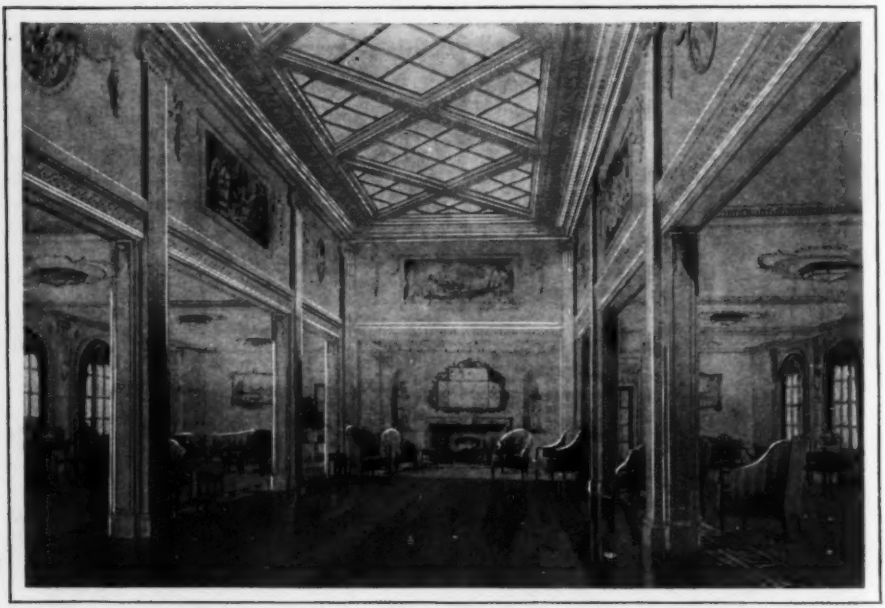
The marine engineers have also applied their knowledge to the elimination of waste energy, and boast that they have succeeded in converting the exhaust-gas heat into steam at 100 pounds' pressure, which will perform menial labor around the ship.

The hull is designed along lines approved by the latest research with ship models, and is said to cut resistance to a minimum. To know that this shell of steel was first planned on paper with mathematical formulas is perhaps less wonderful than the fact that it is made up of hundreds of individual plates of alloy steel welded into a shapely mass by 3,000,000 rivets weighing 650 tons. The rudder itself weighs thirty-six tons, equal to the displacement of a whole passenger ship of the seventeenth century.

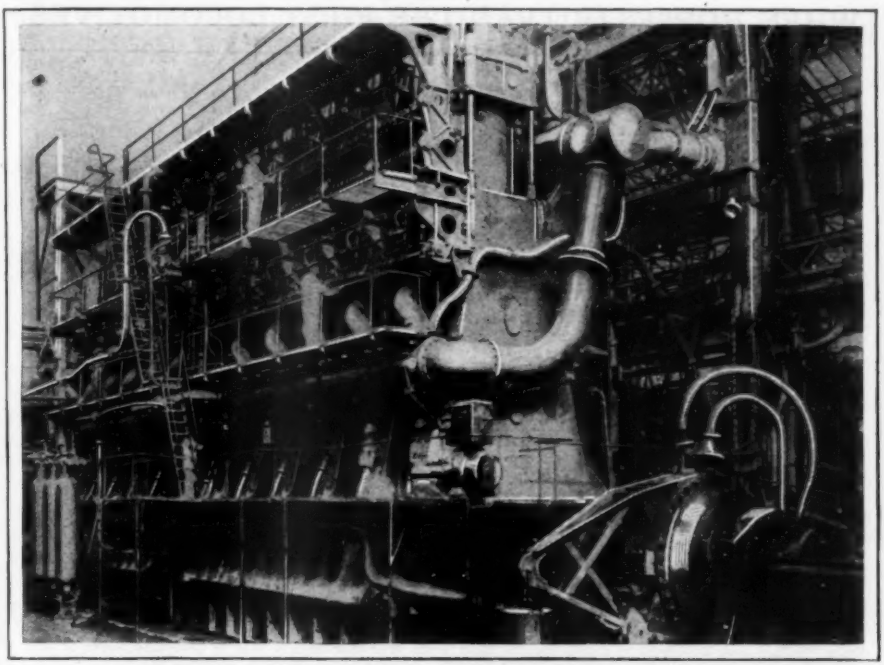
As to the "Britannic's" possible speed, none of her architects or engineers will venture an opinion before she is given a trial run. They have made no claim that she will break any recent record for the Atlantic crossing, but they do hold that she will be the most modern vessel afloat when she is commissioned.

The comfort of the passengers will be stressed by the "Britannic's" appointments. Cabin, tourist and third class will provide commodious quarters for 1,550 persons. The cabin class will have a swimming pool and tennis court; the tourist and third classes will have a children's playroom and special elevators for communication between decks. The dining salon is, for the most part, two decks high, and is dignified by deeply recessed and richly paneled archways extending to a coffered ceiling.

The "Britannic's" appointments have aroused only a fraction of the interest that people show in her mechanical equipment, largely because Diesel-electric plants have only recently been adopted



Luxurious Cabin Lounge of the "Britannic"; the Giant Motorship Also Is Equipped with Swimming Pools, Tennis Courts, Playgrounds and Electric Elevators for Travel between Decks



Picture of Starboard Engine of "Britannic" Taken Just Before It Was Placed in Ship; Its Cylinders Are Large Enough to Allow an Engineer to Climb into Them for Inspection

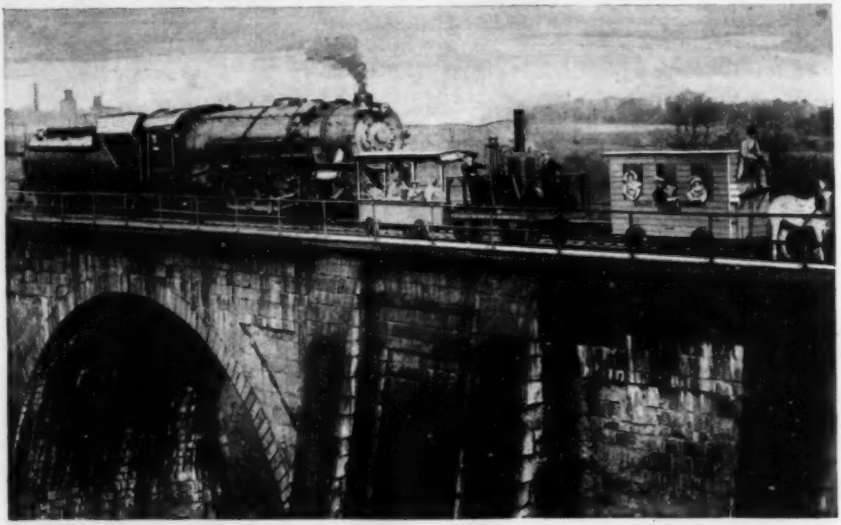
in fast ocean greyhounds. The Caspian steamer "Wandal," built in 1903, was the first sizable ship to employ an internal-combustion engine. Several submarine Diesels were fitted in German cargo ships after the war. Only since then have ship operators come to realize that Diesels in large passenger ships would mean a saving in space and running costs. In 1924, the "Gripsholm," 17,716 tons, was launched for the Swedish-American line. In the same year a great advance in tonnage was realized with the "Asturias," 22,000 tons, for the Royal Mail Steam Packet company. Since, the Italians, Germans, Hollanders and Americans have taken to motorships.

Peculiarly, all of these motorships could dispense with funnels, for they have only to get rid of their exhaust fumes. But it is for the pleasure of the public that shipbuilders give motorships funnels. A traveler might feel ill at ease were he to board a ship without one, and would certainly miss something, for a funnel adds to the grace of a ship's lines.

Since 1910, there has been a steady tendency toward building more motorships. It may safely be said that half of the world's new ships are equipped with internal-combustion engines. A comparison between the old coal burners and the modern motorships indicates that there is an increase in a vessel's initial cost, but this is offset by a reduced fuel consumption, less bulk and weight, more cargo space, and a smaller payroll. In addition, oil burners offer more comfort to passengers, because they avoid soot. Ordinarily, a motorship can carry ten per cent more cargo than a coal burner.

The cost of bunkering a ship with oil is much less than coal bunkering. The number of stokers saved by liquid fuel is shown in the case of the "Olympic," whose four funnels have been converted from smokestacks to exhaust pipes. When she burned coal, the "Olympic" employed 246 men on her "black squad." After her conversion, she required only sixty men, and could have managed with less if ship operators had not heeded a plea from trade unions that unemployment would result.

WHEN HORSES OUTRAN THE FIRST LOCOMOTIVES



© U. & U.

Stone Viaduct over Which First Baltimore and Ohio Train Was Run Still in Use in Maryland; over It Are Passing a Horse Car, a "Tom Thumb" Engine and a Modern Locomotive

Horse-drawn cars which raced America's early locomotives usually were declared winners because the engines were able to make a speed of only about eight miles an hour. At first wooden rails were used with an iron strip laid flat on top, but these were discarded when heat and frost caused them to curl up. The status of conductors was a grave question, some maintaining the conductor to have the standing of a general in charge of troops and others declaring him to be in the position of a gentleman-treasurer. In any event, the first conductors supported their dignity with plughats, frockcoats and high choker collars, using a large wooden box to collect cash fares and distributing heavy cardboard tickets which were used repeatedly. Passenger coaches were lighted at night with two candles, and as they were unheated, urchins earned pennies by selling hot stones to passengers as foot warmers. Much excitement was created when an engine, after many predecessors had failed, finally beat a horse. The engine made a trip in forty-five minutes, but the horse took seventy-five. First trains of the Baltimore and Ohio railroad were operated over an old stone viaduct near Mt. Clare Junction, Md., one hundred years ago, and recently, over this same bridge, which is still in use, one of the old "Tom Thumb" engines puffed its way, preceded by a horse car and followed by the latest type of locomotive.

CLOCK PULLS DOWN WINDOW BEFORE YOU GET UP

Closing the window of the bedroom on a cold morning is a task now performed by a clock which attaches to the window sill. The clock is set for a half hour or an hour before time to get up. A coiled spring provides the operating force, the clock tripping the spring's catch at the proper time, thus causing the

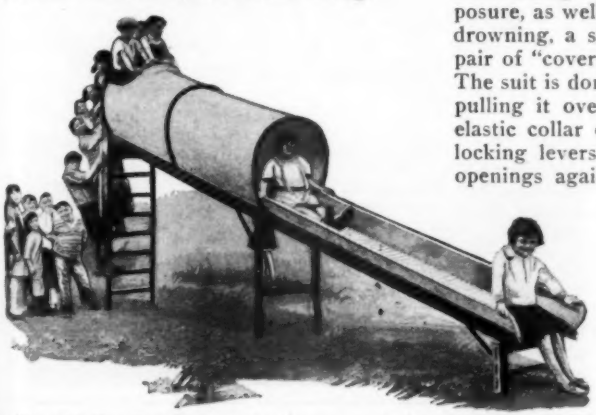
spring to pull down the window so that the sleeper wakes in a warm room. The window may be lowered from various levels, and the clock is fastened to the sill in a few minutes.

BARGE WELDED IN ONE PIECE CONTAINS NO RIVETS

Containing not a single rivet, a barge welded into a solid piece recently was launched in New York and has attracted much attention among shipbuilders since it represents virtually a one-unit vessel. The welding process was found to offer a saving of twenty per cent in building cost, twenty-five per cent in weight and twenty-five per cent in time required for construction. Maintenance costs also were reduced. Leakage of liquid cargo around corroded or sprung rivets is obviated, an important point to shippers, as three per cent of liquid shipments, such as oil, usually is lost through leakage in transit.

ROLLERS ON SURFACE OF SLIDE SAVE CHILDREN'S CLOTHES

Saving the clothing of children who enjoy the slides in the park playgrounds, a slide with a series of metal rollers instead of smooth runners now is available. The rollers are set so close together that there is no jar in passing over them and no opportunity to catch clothes or injure fingers. The top of the slide is inclosed to prevent the youngsters from falling.



Slide with Top Part Inclosed and Surface Equipped with Rollers to Make This Popular Children's Sport Doubly Safe

Testing a Water-Tight Safety Suit Which Protects Wearer from Exposure While in Water

SAFETY SUIT LIKE "COVERALLS" WARM AND WATER TIGHT

Providing complete protection from exposure, as well as saving the wearer from drowning, a safety suit that resembles a pair of "coveralls" now is on the market. The suit is donned by stepping into it and pulling it over the clothing, slipping an elastic collar over the head, and turning locking levers which seal the suit at all openings against water. Life-preserving pads fastened to the outside of the suit keep the wearer afloat and he is held upright by weighted soles of the shoes. It keeps the wearer warm in the water, and is provided with a pocket for carrying liquid nourishment. The suit may be packed in a small bag.

Bread Slicer Which Cuts and Wraps 1,000 Loaves an Hour Ready for Housewife to Serve

BREAD SLICER CUTS AND WRAPS THOUSAND LOAVES AN HOUR

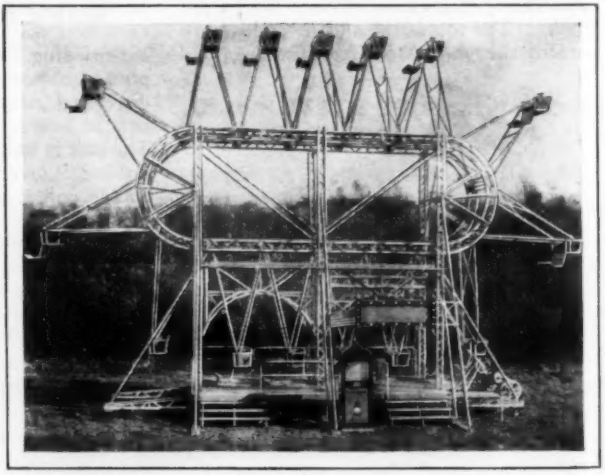
Bread that comes to the housewife ready-cut is now on the market in many cities, a slicing and wrapping machine doing the cutting and packing the cut loaf in a waxed container to keep it fresh. The machine cuts 29,000 slices an hour from 1,000 loaves. The bread, ready for using when unwrapped, is particularly adapted for sandwiches, because it is evenly and smoothly cut.

FIRE AND WATER FROM ONE PIPE OF WELL

Water at a temperature near freezing and a flame hot enough to fry eggs both flow from the same pipe of an artesian well in southern Alabama. The well was drilled by a company searching for coal deposits. No coal was found, but water so cold that it could be used for refrigerating purposes gushed forth to supply near-by campers. One camper happened to hold a match near the water and was startled when it burst into flame. The flame, however, does not heat the water, which remains at about the same temperature. Physicists explained the phenomenon by determining that the well had punctured a gas pocket. The gas, when released from pressure, cooled the water, but, when coming from the mouth of the pipe, could be lighted.

"SWOOPER" GIVES ALL THRILLS OF AIRPLANE RIDE

With four speed changes every round, an amusement park ride that gives some of the sensations of a trip in an airplane now is being produced. The apparatus, called a "swooper," somewhat resembles a Ferris wheel, except that it is oval in shape and the arms to which the seats are attached are rigid, although the seats themselves turn with the motion of the body. On entering the car, the occupant gradually starts backward on a straightaway, then suddenly rises at about three times the former speed, proceeds forward for some distance at decreased speed, and as suddenly swoops downward at the other end of the oval, giving combined sensations of Ferris wheel and airplane.



Oval-Shaped Wheel Giving Four Changes of Speed with Each Revolution Provides Some of Thrills of Riding in an Airplane

COLOR ORGAN PAINTS BALLROOM WITH MAGIC LIGHT

Artist's Drawing of the Bal Tabarin, Hotel Sherman, Chicago, Showing the Installation of Thomas Wilfred's "Clavilux" and the Effects It Produces on the Walls, Which Are Literally Painted with Light

Oriental gardens, desert mirages, swirling stars and other unusual effects glow and dissolve on the walls of the Bal Tabarin in Hotel Sherman, Chicago, where practical application has been made of Thomas Wilfred's "Clavilux." This was hailed as the birth of a new art when it was first introduced, but few persons saw, at that time, more than an unusual exhibition of lighting phenomena. Now it promises wide use in theatrical and other fields. Scenery for the stage of the future may be projected as light instead of being constructed of materials. Whole schemes of interior decoration can be altered in a few seconds.

The hotel's ballroom walls, about 3,000 square feet of surface in all, in reality are blank. Suddenly, stately Grecian pillars appear. They look as solid as stone. They glow with changing colors against what appears to be a sky of infinite depth. A sea opens up behind the columns, ships loom out of the dim horizon, then disappear. The entire scene dissolves and gives place to a performance of slowly whirling light masses that suggest the nebulæ of the heavens. A sort of mechanical seance gives evidence of the magic accomplishments of expert lighting artists and engineers. As the mysterious figures fade, the walls assume the appearance of the bottom of the sea where weird shapes slip about, and the entire area glows with a soft hue, associated with the depths of tropical waters.

The source of these bewildering apparitions is in the ballroom's ceiling. From a specially constructed projection room, an electrical engineer, seated at a light keyboard is "playing" the illumination that paints three entire sides of the room. Twenty-seven hidden projectors, all operated from this central keyboard, are so arranged that they furnish the entire scheme of decoration for the whole room. This is the first ballroom in the world to use light exclusively for interior decoration. A special feature of the installation is that lodge and club insignia or special signs of any kind can be projected with the display, saving the construction of huge banners and other devices usually required to decorate the walls.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

Man-Made

Molten Metal Flowing from One of the Smelting Industry's Highly Developed Aids, an Electric Furnace Used in Making High-Tension Steel

By JOHN DRAPER

MYSTERY metals that possess strange properties of medical and industrial value are yielding their secrets to scientists of the bureau of mines in a special laboratory which has been set up for that purpose at Reno, Nev.

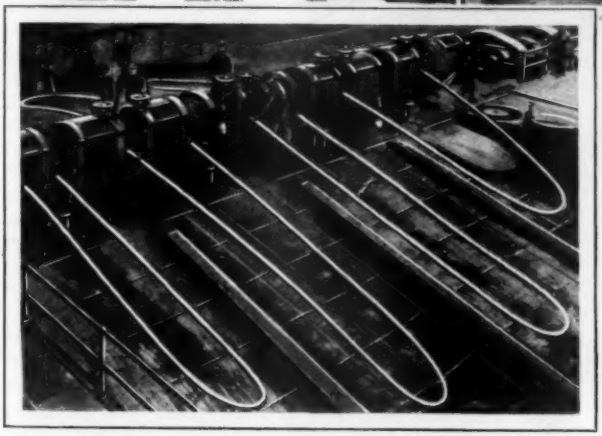
A collection of rare metals from all over the world has been assembled, and efforts are being made to find substitutes for those of which this country does not possess an adequate supply. Some of the more important metals in the group include vanadium, radium, uranium, tungsten, titanium, tantalum and molybdenum.

The strange qualities of tantalum have long baffled the scientists. It is one of a pair of metals that are unknown separately, although columbium, the other member of the pair, is sometimes reported alone in minerals. Tantalum at first was used as a filament in electric lamps, but tungsten was soon applied to the same use and was so much better, owing to its higher melting point, ease of working and abundance, that it promptly superseded the rarer metal. Tantalum will allow an electric current to flow only one way. An alloy of tantalum and nickel for making instruments and parts of chemical apparatus resistant to chemicals and oxidation, has been patented. It is said to be very tough, easily hammered and drawn, and has a breaking strength "which decidedly surpasses that of the best steel."

Titanium, another rare metal, is just now coming into more extensive use in the manufacture of pigments. It is being used in baked enamel, lacquer, printing ink, wall paper, rubber, oilcloth, linoleum and window shades. The metal is found in beach sands at Redondo, Calif., and at Jacksonville Beach, Fla. On the Pacific coast it is believed that the deposits in the beach sands at Redondo were carried down from the San Gabriel mountains north of Los Angeles by tributaries to the Los Angeles river, and thence along an ancient course to Redondo instead of to San Pedro where the river now empties into the Pacific.

Tungsten, wonder metal of the world, credited with playing an important part in the winning of the world war and an equally important part in the phenomenal expansion of American industry since the war, is being made the subject of special study. No other metal produced in such small quantity, say the government scientists, has the industrial importance and has such an influence on the comfort of people at large as tungsten. Its use in incandescent lamps in place of the carbon filament it superseded saves large quantities of electricity. It gives a quality of

Mystery Metals



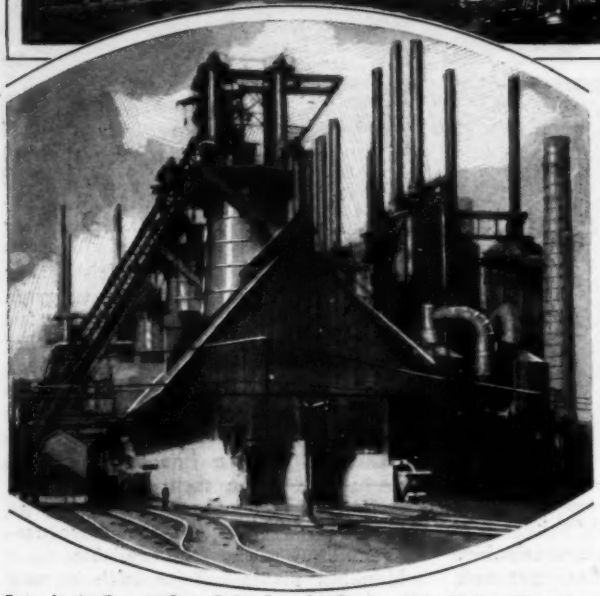
Rollers That Convert a Copper Bar into a Thin Rod Speed the Manufacture of Wire and Cable

light otherwise practically unattainable. It has made possible the flashlight and an X-ray tube which generates rays so hard that almost instantaneous Roentgenographs of the body can be taken.

For all these uses, not more than 100 tons of tungsten concentrates, valued at $60,000 to $65,000, is used annually. Most tungsten is used in tool steels for forming metals. It is estimated that one man with one lathe and tungsten-steel tools can do as much work as five men with five machines and carbon-steel tools. The metal is being used in radio tubes, electrical contacts, airplane and automobile valves. An automobile manufacturer declared recently that, if he had to use the old carbon tools, the cost of production would be increased $200 per car over present prices. The government scientists aver that, but for tungsten tools, it is doubtful whether shells and other cut steel could have been supplied in the war in the quantities needed. It would probably have been impossible to find the men, machines and shop room necessary to turn out the indispensable munitions in the time available.

Mankind plants infinite faith in new alloys. They make possible swifter aircraft, larger ships, longer bridges, higher buildings, sharper tools, fireproof structures and more sanitary living. Civilization enters an area of supermetals, where high-tension steels, rustless cutlery, stainless alloys, magnaliums and combinations of rare metals command on every front. But they are merely forerunners of metallic substances which will enable men to control many natural forces.

Some years ago, a bridge span fell into the St. Lawrence river, killing several people. Blame could hardly be laid on the



Scene in the Famous Great Lakes Iron-Ore Region, and a Modern Blast Furnace Where Ore Is Melted

engineers, who were faithful and sincere in their duties. What had happened? The steel members merely tired of holding up. When one girder slipped, the load taxed the bridge structure and the whole collapsed. This tiring of steel applies to other metals also. It is usually called "fatigue."

Fatigue is a nightmare of metallurgy. Not much is known about it, although engineers clamor continually for more light on the subject. Whenever force is applied to metal its shape alters. If a girder is properly designed, it resumes its initial form after the force is removed. The change in dimension is called "strain."

The importance of fatigue can hardly be overestimated. It concerns the safety of everybody. When a bridge buckles, a roof collapses, or a car wheel breaks, in eight out of ten cases, the cause of failure is fatigue. The mishaps come suddenly, for metals cannot cry out when too tired to stand up. But metallurgy has not despaired of eliminating fatigue. The antidote will come with the perfection of truly elastic metals. Extra-light alloys are substances to conjure with. Chemistry and metallurgy produce them in amazing abundance and variety.

The yardstick of airplane construction and design is "pounds per horsepower." When you decrease weight, you amplify horsepower. Manufacturers discovered aluminum and its alloys early in airplane history. Here is a metal, one-third as heavy as steel. Duralumin is the name ap-

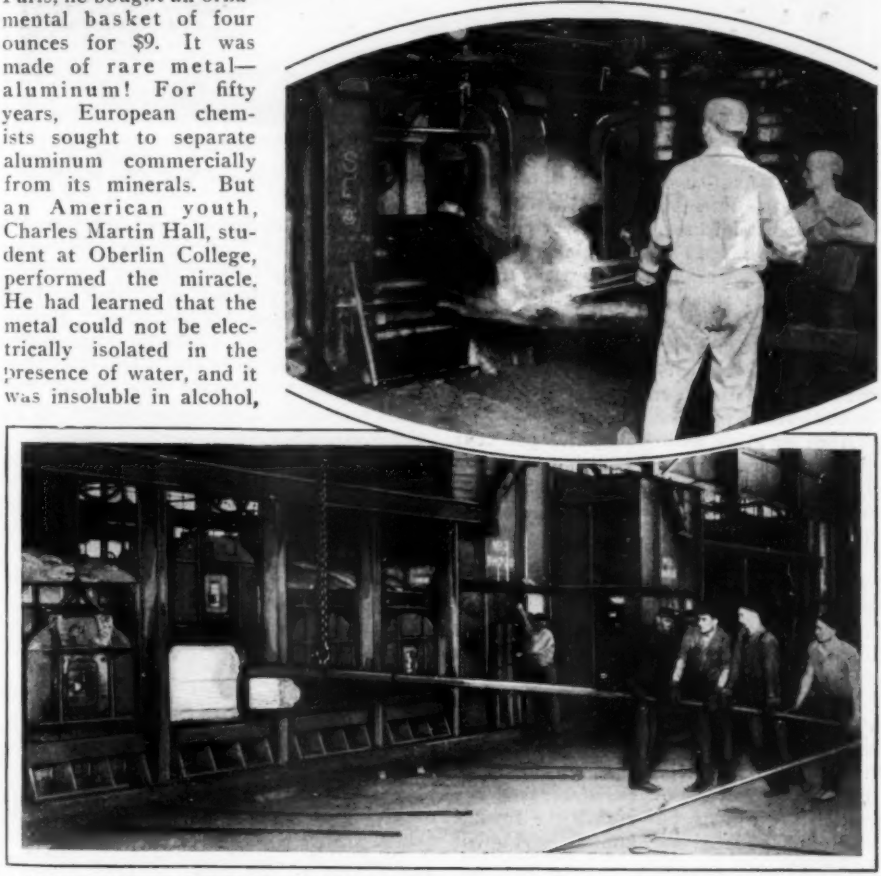
plied to a whole group of super-light alloys containing about ninety-four per cent of aluminum, four per cent copper, one per cent magnesium and one per cent manganese. Aeronautics would still be in its infancy if it were not for duralumin.

If aluminum is alloyed with silicon or magnesium, its weight is reduced. All other metals increase the initial weight. The presence of silicon in aluminum was formerly considered harmful, but recently alloys with eleven per cent of silicon were created, and they promise to be the most valuable light casting alloys.

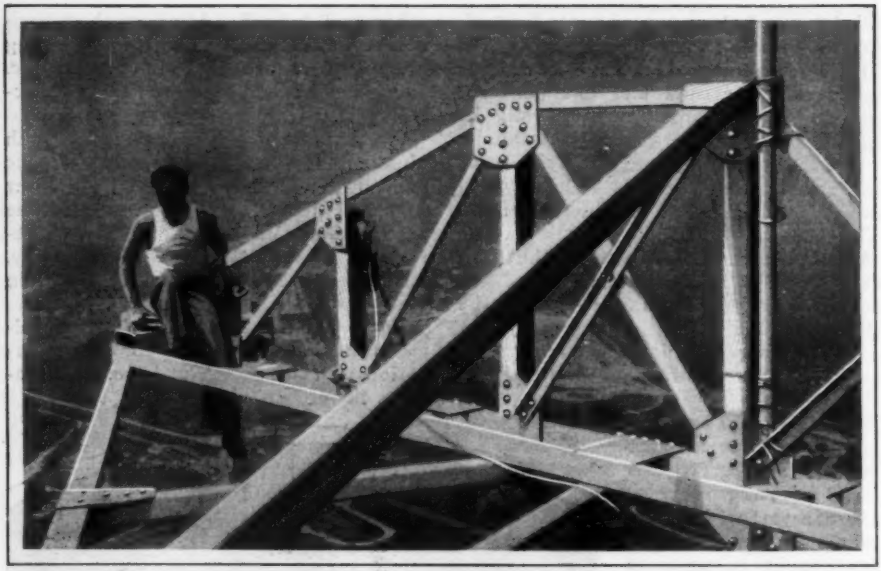
The story of aluminum is phenomenal and arresting. In 1869, when Dr. C. F. Chandler, the American chemist, visited Paris, he bought an ornamental basket of four ounces for $9. It was made of rare metal—aluminum! For fifty years, European chemists sought to separate aluminum commercially from its minerals. But an American youth, Charles Martin Hall, student at Oberlin College, performed the miracle. He had learned that the metal could not be electrically isolated in the presence of water, and it was insoluble in alcohol, ether and benzol. After much experimentation, he succeeded in dissolving aluminum ore in the mineral cryolite. Later, he obtained the pure metal by electrolyzing the solution.

A metal called chromium competes with aluminum for fame. Chromium is the substance that keeps table cutlery clear of spots; it preserves the luster of the auto radiator; it makes printing rolls resistant; it gives steel a rustless quality. In short, here is a metal whose role in daily life commands respect.

Some of the newest alloys are nickel-chromium compounds. They resist corrosion well but soften at lower temperatures than steel.



Preparing a Sheet of Nickel Alloy of the Right Thickness by Rolling It between Powerful Rollers, and Heating a Nickel Ingot to the Proper Temperature



Courtesy U. S. Navy

Sailor Perched on Top of a 600-Foot Radio Tower at Arlington, Va.; Rust-Proofed Steel Alloy Has Made the Construction of Such Towers Practical

For industrial uses, there is promise in the new "nitrided" steels which can produce excellent casehardening without distortion. A lead-calcium alloy with high fatigue strength was recently discovered.

Copper also finds a place in the present research. A copper-beryllium alloy has the highest tensile strength ever reached in nonferrous metals.

Another alloy with ninety-five per cent silver, and small doses of copper and aluminum, resembles sterling silver. It has possibilities as a coin silver and also for tableware.

In the cast-alloy field, a process called "modification" is being developed; it is a science based on the proposition that, by adding a small quantity of another element, the desirable properties of an alloy are increased.

Permalloy, a superior magnetic material, can now be furnished in a ball mill, molded into rings and hardened for use in long-distance telephone transmission. The use of permalloy has decreased the size of the ring to one-eighth the former size and effected an annual saving of $1,500,000.

The commercial possibilities of rare metals and uncommon ores have recently been exploited. For instance, the metal cæsium became famous almost overnight. It has a silvery luster on a fresh surface and greatly resembles potassium. Before 1926, cæsium was a chemical curiosity. Then the radio industry discovered that it could be compressed into "pills" and used to extract minute remnants of air in radio vacuum tubes.

The iron-gray metal cerium has been made to alloy with iron, zinc, magnesium and aluminum. It is used as a "sparking" metal in ignition devices, such as pocket lighters and gas lighters.

Selenium, once very obscure, has found commercial uses. It is employed in the manufacture of ruby glass and red enamels. It also increases the toughness of rubber in sheathed wire cable.

The metal thallium was recently discovered to be an effective poison for rodents and ants. It is superior to arsenic, strychnine and phosphorus, being tasteless and odorless. The metal also is necessary in the manufacture of photoelectric cells.

And so the earth's materials are yielding to inventive magic.

FIVE-STORY CHICKEN HOSTELRY HAS ELECTRIC ELEVATOR

Equipped with every convenience a fastidious hen could ask, including electric lights, running water, air ventilators, a vacuum-cleaning system and an electric elevator, a five-story "hen hotel" has been constructed by California poultry raisers. It houses 3,200 laying hens and an addition, when completed, will bring the capacity to 10,000 chickens. The present unit is forty-eight by fifty-eight feet, each floor being divided into four pens. The building has east and west exposures and is covered by glass sash. Each hen has three square feet of space and all "furniture," including nests, roosts and mash hoppers, is elevated. The electric elevator takes the feed up and the eggs down.

TALKING MOVIES FOR HOME NOW EASILY MADE

Talking motion pictures are taken and displayed in the home with the aid of a compact outfit that also includes a radio. A phonograph record is synchronized with the film so that the voices or other sounds are registered at the same time that the picture is taken and are reproduced again in proper agreement with the reel. The radio can be played as an accompaniment to non-talking films.

Compact Outfit for Taking and Displaying Talking Movies in Home Also Contains a Radio

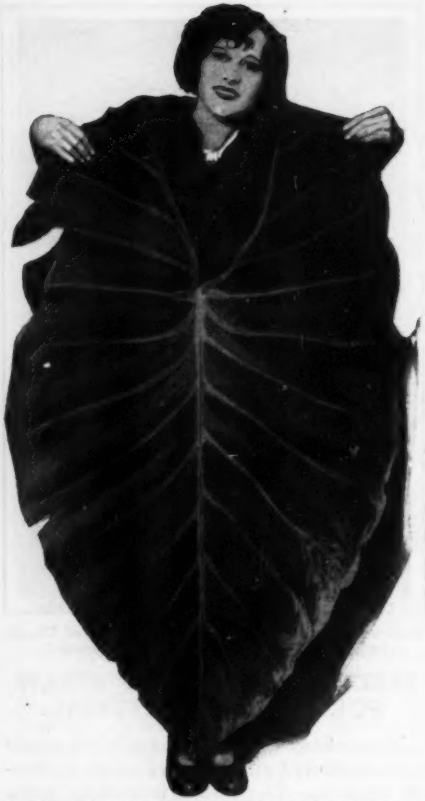
Workmen Demonstrating That Walls Made of Chemically Treated Straw Have Been Fireproofed

FIREPROOF WALLS OF STRAW FOR BUILDING MATERIAL

Non-inflammable walls made of straw were exhibited at a builders' show in Berlin recently. The straw, treated to make it fireproof, is pressed and bound in layers, and its makers claim that the product is ideal for construction purposes with the fire hazard eliminated, particularly as a means of making a house weatherproof.

ULTRA-SHORT WAVES FOR RADIO

Application of ultra-short radio waves that vibrate almost as fast as infra-red rays, for radio messages has been accomplished successfully by a German scientist. These wavelengths, perceptible only by their production of heat, extend in length from a few decimeters down to one-thousandth of a millimeter, reaching thus into the sphere of invisible light rays. A detector sufficiently sensitive to react to such rays was found in a selenium cell with an alloy of tallium sulphide. A transmitting tube of only 100 watts was used for telephone and radio messages.



A Giant Elephant's-Ear Leaf, Almost Five Feet Long, Is the Unique "Dress" for This Girl

GIGANTIC ELEPHANT'S-EAR LEAF MAKES MODEL FOR DRESS

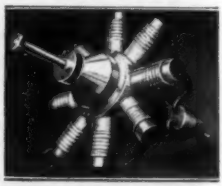
Almost five feet long and thirty-eight inches wide, a mammoth caladium plant, more commonly known as an elephant's ear, has been grown by a resident of Fresno, Calif., in his front yard. The leaf, draped about a girl of average height, almost enveloped her and, without any alteration, formed a unique dress model.

DEAD LETTERS COST MILLIONS TO GOVERNMENT ANNUALLY

Operation of the dead-letter office costs the government about $5,000,000 annually, most of which could be saved if those who use the mails exercised greater care in addressing. A letter is pronounced dead and sent to the morgue for defunct mail after it has, in many cases, made seven or eight trips back and forth between the city where the sender lives and the city to which it is addressed, with frequent side journeys to many other places in the government's effort to deliver it. Innocent-looking missives are found to contain anything from the message of a lovelorn swain to a poisoned needle, or a powder capable of bringing on sleeping sickness; so, great care is exercised in opening the dead letters. Out of 25,000,000 pieces of mail handled annually by the dead-letter office, about 500,000 find their way back to the senders. Once a year there is a general house cleaning when valuables found in letters are sold, letters containing nothing of value are destroyed, eventually finding their way to the government printing office as wood pulp, and money contained in letters is turned over to the treasury. It has also been estimated that 200,000,000 pieces of mail yearly are given directory service, which means that postal employes find the person to whom such mail is addressed by scanning telephone and city directories.

TINY COMPRESSED-AIR MOTOR DRIVES MODEL PLANE

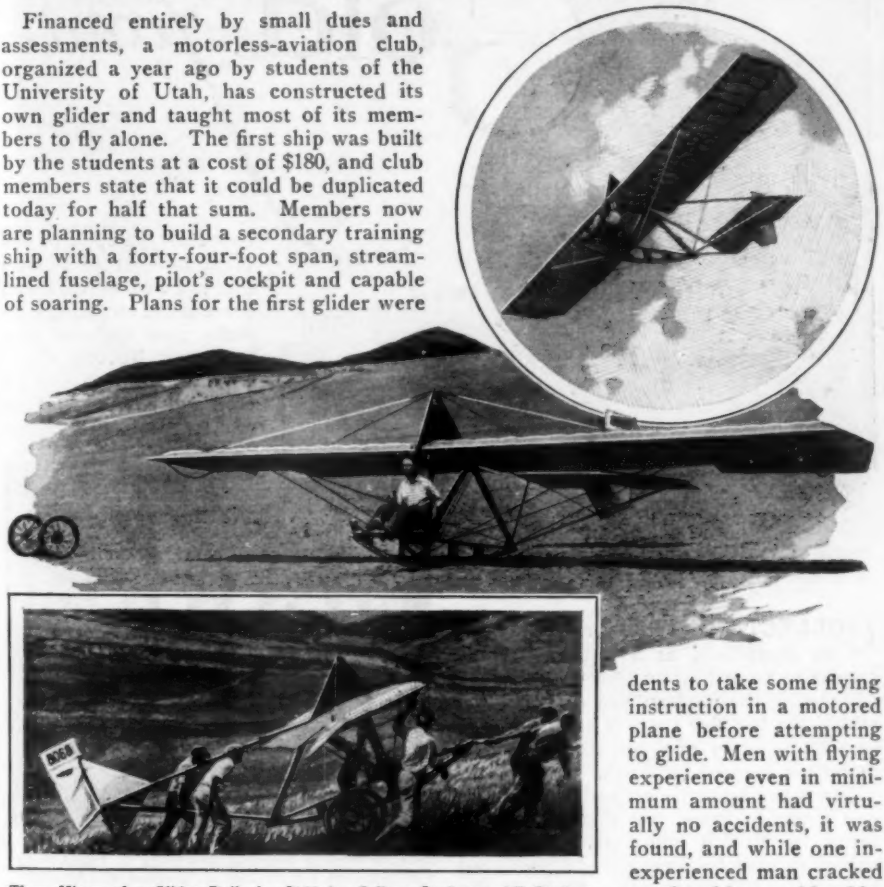
Model airplanes, powered with compressed-air motors of six or eight cylinders and weighing from four to six ounces, now are being produced. The motor is constructed of aluminum and may be detached from the air tank. The air control allows it to idle for five minutes or run full speed for one minute. The six-cylinder motor turns a seventeen-inch propeller at 1,200 revolutions per minute, and drives models up to thirty ounces in weight and with a wing-spread of from four to six feet.



It is three and one-half inches wide, has a three-eighth-inch bore and a three-eighth-inch stroke, and weighs four ounces. The eight-cylinder type is slightly larger and weighs six ounces, while the tanks weigh from ten to twelve ounces.

COLLEGE GLIDER CLUB TEACHES LOW-COST FLYING

Financed entirely by small dues and assessments, a motorless-aviation club, organized a year ago by students of the University of Utah, has constructed its own glider and taught most of its members to fly alone. The first ship was built by the students at a cost of $180, and club members state that it could be duplicated today for half that sum. Members now are planning to build a secondary training ship with a forty-four-foot span, streamlined fuselage, pilot's cockpit and capable of soaring. Plans for the first glider were



Three Views of a Glider Built for $180 by College Students; All Student-Members of the Glider Club Learned to Fly in It

checked by engineering professors of the university, and after a series of short test flights by the only member of the club with previous flying experience, novices took the controls, the ship being held down by ropes which allowed it to rise only about six feet. It was discovered that any person with a minimum of flying experience in a motored plane—as little as twenty minutes at dual controls—could fly the glider without trouble, and with inexperienced men, even the most timid, the technique of managing the sailplane was learned in a slightly longer period, but club members advised all glider students to take some flying instruction in a motored plane before attempting to glide. Men with flying experience even in minimum amount had virtually no accidents, it was found, and while one inexperienced man cracked up the ship considerably, there were no serious accidents to glider or students in more than 180 flights, some of them from 150 to 400 feet from the ground. Motorless flying was found to be a successful and inexpensive way to gain flying experience, due to the fact that the cost of the student-built plane was moderate and its upkeep virtually nothing, and those flying a glider were forced to rely entirely on the sense of equilibrium, an important accomplishment for the pilot, and one gained more easily in a glider.

¶It takes seven years to bring an orchid plant to maturity.

Gold from

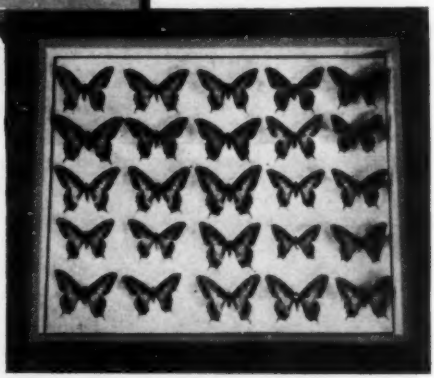
By H. H. DUNN

COLLECTING anything so fragile and so short-lived as a butterfly would appear to be at best an uncertain method of meeting the modern cost of living, yet within the last five years it has developed into an industry of some size, especially in certain favored localities.

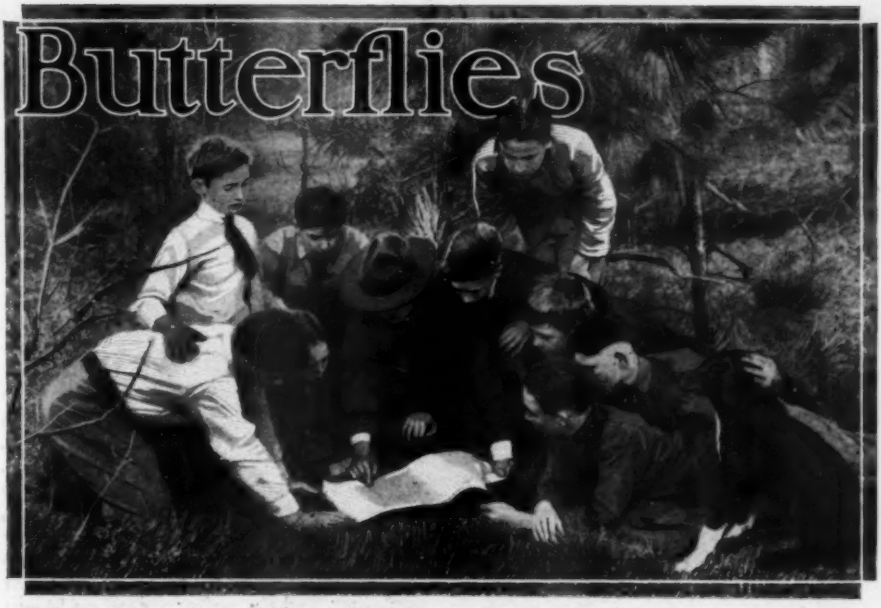
Just when butterfly collecting began no one seems to know, but there are specimens in British museums which are known to have been caught and preserved more than 100 years ago. Early in the eighteenth century butterfly hunters, called "aurelians," were held up to mild ridicule. Less than fifty years ago, the man who was seen, net in hand, pursuing insects across the fields was laughed at as a sort of harmless lunatic.

But all this has changed. Through the efforts of butterfly and moth collectors, it has been learned, for example, that there are more than 8,500 species and subspecies of butterflies and moths in the United States. Of these, less than 700 are butterflies, so that there are more than 7,800 kinds of seldom seen moths in this country.

There are only two kinds of butterfly collectors, in spite of the great number of butterflies to be collected. First, there is the scientist, who seeks new varieties and to know better those which have been discovered and classified. Second, there is the collector and breeder, who seeks only the brilliantly colored specimens for the making of jewelry, fans, screens and for other ornamental bric-a-brac. The accomplishments of the scientist appear only in museums and private collections; those of the commercial collector are sold from the shops of New York to the annual fair at Nijni-Novgorod. The financial returns to the scientific collector average probably less than ten cents a specimen; those of the commercial collector and breeder range up to twenty-five dollars per butterfly or moth. Both are artists, the one adding materially to the sum of human knowledge and the other adding beauty



Collector Placing Prepared Specimens in Insect-Proof Drawer, and Sample Case of "Swallowtail" Species



Field Class Studying Habits of Moths and Other Insects; This Work Has Become Increasingly Popular in Grammar and High Schools Recently and Is an Aid to Future Farmers

and attractiveness to human surroundings.

Recently, a private collection of American butterflies and moths, embracing more than 400,000 specimens, was offered to the Smithsonian Institution at $350,000. This is considered a nominal price by those familiar with the collection, as it is estimated that it actually cost its owner more than half a million dollars. Six large screens, each about five by ten feet, and each containing approximately 100 butterflies and moths, sold recently for $2,500. No two specimens in these screens are alike; they came from all parts of the world, and all are brilliant, perfect insects. The cost of collecting and preparing the butterflies and moths, and inclosing them in the screens, is estimated at $1,250, leaving a better proportionate profit for the commercial collector than the scientist will receive for his huge collection, if and when he sells it.

Both kinds of collectors use the same methods of finding and capturing their fragile trophies, but the commercial collector frequently rears his moths and butterflies from the caterpillar stage in large numbers so as to obtain perfect specimens. Probably no other form of collecting is so difficult, nor the preparation of specimens so delicate a task as that of the butterflies and moths. The wing surfaces are covered with tiny, rainbow-hued microscopic scales, finer than dust. Whenever a wing is touched, these scales are rubbed off and some part of the coloring destroyed.

Yet, from the jungle-covered interior of the tropics and from the remotest islands of the seven seas, tireless scientists bring back perfect specimens, the "bloom" of their wings uninjured. One such collector, working in the interior of an island in the West Indies, found a butterfly which exists only in a limited area on this island. He brought back enough perfect specimens to pay the expenses of his expedition, receiving as high as twenty-five dollars each for them.

Most butterflies are taken in nets as they hover over plants; a few are reared from caterpillars. The majority of moths are caught in traps in which a light is the lure, captured with a sweet bait smeared on tree trunks, or reared as are the butterflies. When one remembers that there are more than 7,800 species and subspecies of moths in the United States alone,

One of the Several Forms of the "Swallowtail," a Common but Beautiful Variety Abundant in the United States

it will appear that for the scientific collector this field is almost inexhaustible.

The collector, scientific or commercial, fares forth armed with a fine-meshed net, with a ringed aperture about fifteen inches in diameter, and a soft bag, two feet long, the size varying with the fancy of the man using it. Knowing the haunts of butterflies, he visits gardens, flower-covered fields, brushy hillsides, watercourses and wayside pools, literally skimming his multicolored insects from the air. In a knapsack slung over his shoulder are two or more large-mouthed jars, about quart size, with close-fitting lids. In the bottom of each jar is a layer of cyanide of potassium crystals, held in place with a thin covering of plaster of paris. Into these he drops the larger butterflies or moths, sometimes putting a drop of chloroform on the body of each as he lifts the insect from the net, so that it will not flutter while being killed in the cyanide jar. In his knapsack, too, are a number of large test tubes, well corked and bottomed with cyanide, for the smaller butterflies and moths.

In a notebook, the scientific collector records the date, place, vegetation and other conditions of the capture, as well as the species. The commercial collector, of course, does not bother with such details. The important facts in this record, with sex of insect, he writes on a tag to be placed with the specimen in the collection to which it goes. When the moth or butterfly has succumbed to the cyanide fumes, it is removed and placed between sheets of thin cotton batting, in a collecting box, for transportation to the preparing room.

A few day-flying moths are caught in this manner, but the greater number come from careful search among bushes, in weedy growths along streams, in crevices in the bark of trees, in brush heaps, and from trapping. However they may be captured, the specimens are taken to the preparing room kept at an even, warm temperature. There they are removed and relaxed by placing them in a warm, slightly moist container, and thereafter spread on blocks of soft wood, so that their wings may be displayed to the greatest advantage.

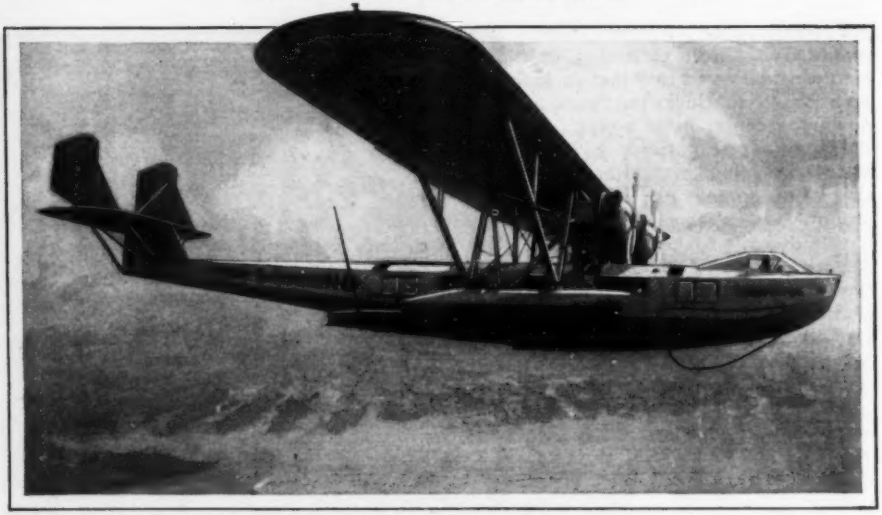
The scientific collector mounts only such insects as he wishes to place in cabinets. The other specimens, with their wings folded, are inserted in small envelopes, on which the necessary identification and descriptions have been placed, and filed in small drawers, similar to those of a card-index system. Thus, while a museum or private collection may have only a few specimens of each species on display, it also may have thousands of other butterflies and moths, put away in envelopes for study or for exchange with other collectors.

The commercial collector mounts all of his specimens, spreading their wings and drying them, usually in an oven specially constructed for this purpose, where heat only slightly above that of the normal house warmth is maintained. The scientific collector does not favor the oven, as it has a tendency to shrink the bodies and to so dry out the insect that eventually it will crumble to dust when handled. Since the commercial collector's butterflies are to be closely and permanently protected by glass, he does not have to guard against this crumbling.

Formerly, the winged insects were mounted by both collectors on boards, eighteen inches to two feet in length, an inch or so in thickness, with a groove down the center large enough to receive the body of the butterfly or moth. Such boards, varying in width according to the wing spread of the insect to be mounted, were somewhat unwieldy, and it was difficult to keep the wings spread flat without rubbing, thereby destroying the minute scales and ruining the appearance and colors of the wings. William Sherman Wright, of the San Diego Museum of Natural History, employs a method of using a separate grooved wood block for each of the specimens, wrapping wings and block with fine, soft thread, thereby making handling easier and reducing possibility of damage to the specimens to a minimum.

The rearing of butterflies and moths from eggs, caterpillars or cocoons is largely a matter of finding the specimens in good condition, providing them with the vegetable food on which they best thrive, and wearing out a large stock of patience and infinite care. Remarkably fresh, brilliantly colored and large specimens may be obtained, while the financial returns from successful butterfly "farming" are not small. Elaborate equipment is not essential to this form of collecting, and a vacant room in almost any weatherproof house, equipped for the maintenance of heat only slightly above the normal comfortable warmth of a home, will serve the butterfly and moth breeder very well. Cages made of soft cloth, like mosquito bar, or very light cheesecloth, may be used for each species, but many breeders merely build racks to contain the food on which the caterpillars live, trays to hold earth in which some hibernate, and branches for the butterflies and moths to cling to as they dry after coming out of the cocoons. Methods applicable to the rearing of silkworm moths will work equally well with the majority of the wild moths and butterflies, according to those who have made a success of this industry.

Moth Specimen Drying; a Collector's Knapsack Containing Tubes and Chemicals, and Drawer of Specimens Drying



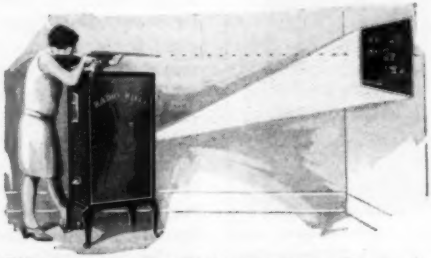
First of Twelve Huge Twenty-Passenger Flying Boats Which Will Carry Mail and Passengers between New York and Buenos Aires, Establishing Seven-Day Service

FLYING BOATS CUT THE TIME TO SOUTH AMERICA

Seven-day service between New York City and Buenos Aires is being inaugurated by giant twenty-passenger flying boats, the first of which has been delivered. Twelve ships in all will take part in this daily spanning of two continents and will carry both passengers and mail.

MILLION BITS OF DUST INHALED WITH EVERY BREATH

With every breath of air, a million particles of dust, spores and microbes are inhaled regardless of the purity of the atmosphere, Dr. W. J. Humphreys, of the United States weather bureau, declares. Every desert wind picks up tons of dust to be scattered for hundreds of miles, fragments of vegetable fiber and pollen of plants litter the atmosphere and are breathed regularly, and smoke from kitchens, factories and forest fires contributes its part to pollution of the air. Even the ocean, with its evaporated spray, makes a salt mine of the air, and lightning sprays acids into the atmosphere, while volcanoes hurl tons of rock powder aloft to be carried for thousands of miles. In addition to all this, the atmosphere to its outermost limits is filled with the ashes of millions of incinerated meteors. Luckily nature has provided the bronchial tubes with chimneysweeps to get rid of a part of this dirt before the air enters the lungs.



Rifle for Target Use Which Registers a Hit by an Electric Spark Instead of a Bullet

SPARKS IN PLACE OF BULLETS SHOW TARGET HITS

Shooting in every respect the same as an ordinary target rifle, except that it contains no bullets, a rifle registering a hit by an electric spark now is provided by some shooting galleries. The rifle is mounted on a cabinet and by inserting a coin, an illuminated target is thrown on a wall or screen. When the trigger is pressed, an electric spark shows where a bullet would have hit the target, which may be thrown eighty feet or less.

THREE LIVES IS AVERAGE PRICE OF MILLION TONS OF COAL

Every million tons of coal extracted from the earth in the United States costs on an average three and one-half human lives, and the bureau of mines has engaged in the country's most vigorous safety campaign to make the mines safe for the miners. Eleven rescue railroad cars have been placed at strategic points to be rushed to mine disasters, and one or two of every hundred miners have been trained in mine-rescue and recovery work, while about 365,000 are trained in first aid. Auto trucks equipped with rescue apparatus also are held in readiness. Prevention, rather than rescue, however, occupies most of the time of mine-safety engineers. Lights that will not ignite the gases and coal dust, explosives that do not set off these gases, and mining machinery and motors that do not spark, are among the equipment used for preventing explosions. Dusting the mine with rock dust to dilute explosive coal dust is another safety measure. However, only eight to twelve per cent of coal-mine fatalities are due to explosions, more than half of the 2,500 lives lost annually being the results of falling coal and rock.

Whirl-Over Swing for Children, Like a Small Ferris Wheel, Also Serves as a Trapeze, See-Saw or Ordinary Swing

WHIRLING SWING FOR CHILDREN LIKE SMALL FERRIS WHEEL

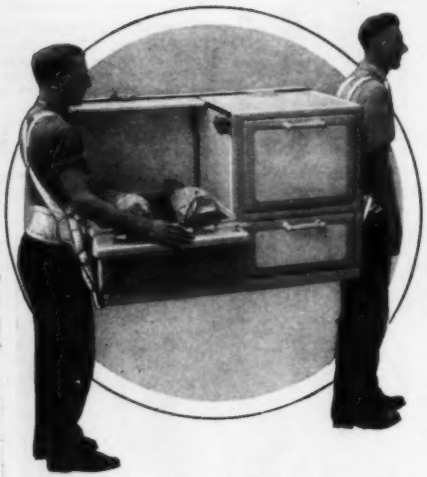
Operating on a principle similar to the Ferris wheel, a whirl-over swing for children now is on the market, being particularly suited to playgrounds or amusement parks. It is constructed of steel, turns on roller bearings, is regulated by a governor and may be obtained with or without a motor. The seats are so arranged that the children are in little or no danger of falling out of the swing. It also may be used as a seesaw, ordinary swing or trapeze.

AUTOMATIC SAW-HANDLE LOCK FASTENS BLADE IN PLACE

Screws and levers are eliminated in a saw handle which contains a plunger that locks the blade. Pressure on the plunger releases it. The handle has a square top so that it does not interfere with work when the blade is reversed for undercutting.

BABIES GIVEN MENTAL TESTS

Dr. Paul H. Furfey, of the Catholic University of America, has tested sixty-two babies between the ages of fifteen minutes and fifteen days to determine at what stage the general intelligence begins to function. He found that babies begin to display mental alertness by following moving objects with their eyes, by grasping with foot or hand when an object is placed within reach, by reacting to a bell, and by other reflexes.



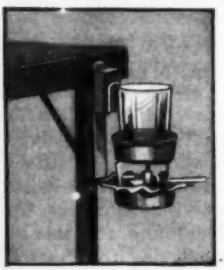
Carrying and Lifting Sling for Two Persons to Facilitate the Moving of Bulky Objects

CARRYING AND LIFTING SLING FOR BULKY ARTICLES

For easy moving of heavy and unwieldy objects, particularly gas and electric ranges, a carrying and lifting sling now is available. It includes a harness which fits around the shoulders and waist of the movers and hooks which attach to the article to be transported. The harness is of strong webbing capable of withstanding a pull of more than 750 pounds.

MATCH, ASH AND GLASS HOLDER ATTACH TO TABLE

Easily attached to a corner of the card table, a tray now is on the market which holds a glass of liquid, and also has a container for matches and an ash receiver. The glass holder may be detached and placed on the table if desired. The three-purpose tray keeps ash receiver, matches and glass within easy reach of the card player, but at the same time out of the way so none is in danger of being spilled.

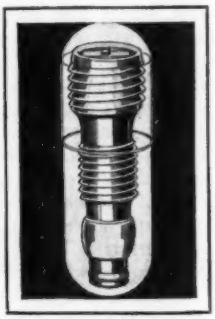


WEATHER FANS AID UNCLE SAM IN DAILY OBSERVATIONS

Approximately 5,000 voluntary weather observers throughout the country are assisting the federal bureau in its work of reporting and recording the daily weather, according to Clarence J. Root, of the United States weather bureau, at Springfield, Ill. Some of them have served for forty years, others for ten, twenty and thirty years, keeping their own records month after month and so supplementing the work of the main bureau. Their reports have been widely consulted and used by engineers, manufacturers, farmers and others, and have been employed frequently in helping to settle law suits.

LOCKING TIRE VALVE KEEPS PRESSURE CONSTANT

Keeping pressure in automobile tires constant, a tire-valve lock now is available. The lock fits all sizes of tires and is installed by removing the ordinary valve inside and inserting the locking valve. Then the tires are inflated to the proper pressure and the valve is locked by tightening a screw at its top. For protection, the valves, in sets of fives, come packed in individual, transparent, air and moisture-proof containers.



ZINC-BASE ALLOYS IMPROVED

Zinc-base alloys used for die castings, formerly suitable only for small parts which were under no strain, now have been improved until they may be used for parts where a tensile strength of from 40,000 to 50,000 pounds per square inch is essential. Such alloys have been used as washing-machine agitators, gears for hoists, carburetors, motor housings and door knockers. The tensile strength of some is greater than brass and bronze.

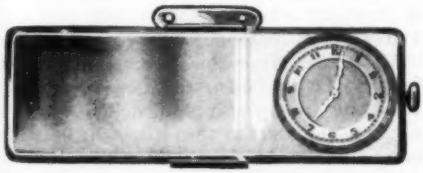
ELECTRIC EYE WORKS SPEAKER WELCOMING VISITORS

Photo-electric tubes, or "electric eyes," heretofore used for various processes, including counting persons passing any given point, now have been set to work as official greeters, and may also be used as watchmen or policemen. Visitors to the Museum of Peaceful Arts in New York are greeted by the words, "Will you please register?" as they step from the elevator, although no one is in sight. The words come from a loud speaker and are contained on a record which starts when anyone passes through a beam of light watched by the eye. At night the record may be changed to a warning to "Throw up your hands," or some other threat to prowlers. The apparatus consists of a photo-electric cell, a light source directed on it and the speaker. When the light to the cell is interrupted by a person passing through it, the cell starts a motor which in turn operates the record.

Tanks Capable of Standing Air Pressure Equivalent to Water Pressure at Various Ocean Depths Are Used to Test Divers' Suits

CLOCK IN REAR-VIEW MIRROR CAN BE SEEN BY ALL

Rear-view mirror and an eight-day clock have been combined into one auto accessory by an English manufacturer. The clock in the wide mirror can be readily seen by all the passengers in the car, or observed by the driver without taking his eyes from the road.



Clock Built into a Rear-View Mirror Where It May Be Readily Seen by All in the Car

TEST DIVERS' SUITS IN TANKS UNDER AIR PRESSURE

Tanks capable of withstanding air pressures which are the equivalent of water pressures at various depths under the sea are used by a German manufacturer of diving suits to test the diving apparatus for safety before it is placed in actual use. Experienced divers don the suits and descend into the tanks. They are in telephone communication with those on the outside as the pressure is applied, thus being able to record their reactions during progress of the test and to give warning in case a defect is found in the equipment.

AIRPLANE THERMOMETER GIVES WARNING TO PILOT

Automatically recording the minimum temperature of the air through which an airplane is passing, a thermometer particularly helpful in high-altitude flights has recently been developed. The instrument is mounted on one of the struts, and warns of ice forming on the wings.

Flying in

The Tractor Proved an Important Aid to the Planes When Ground Conditions Made It Dangerous to Taxi; the Tractor Was Used Also in Hauling Supplies and Moving Camp

PART IV

A PASSENGER train puffed to a stop at Port Churchill, far up on the western side of Hudson bay in September last year, a distinguished gathering descended, and with due ceremony solemnly drove a golden spike to symbolize the completion of the railroad, and the work that Henry Hudson started nearly 320 years ago was completed.

His bay had been opened to the commerce of the world.

Behind that simple ceremony under the eyes of a few guests, railroad and port workers, a scattering of Cree Indians and Eskimos, and the ever-present North West Mounted Police and factors of the "Company of Gentlemen Adventurers Trading Into Hudson's Bay"—otherwise the Hudson's Bay company—lay one of the greatest dramas of the north, a drama that, save for one incident, passed almost unnoticed.

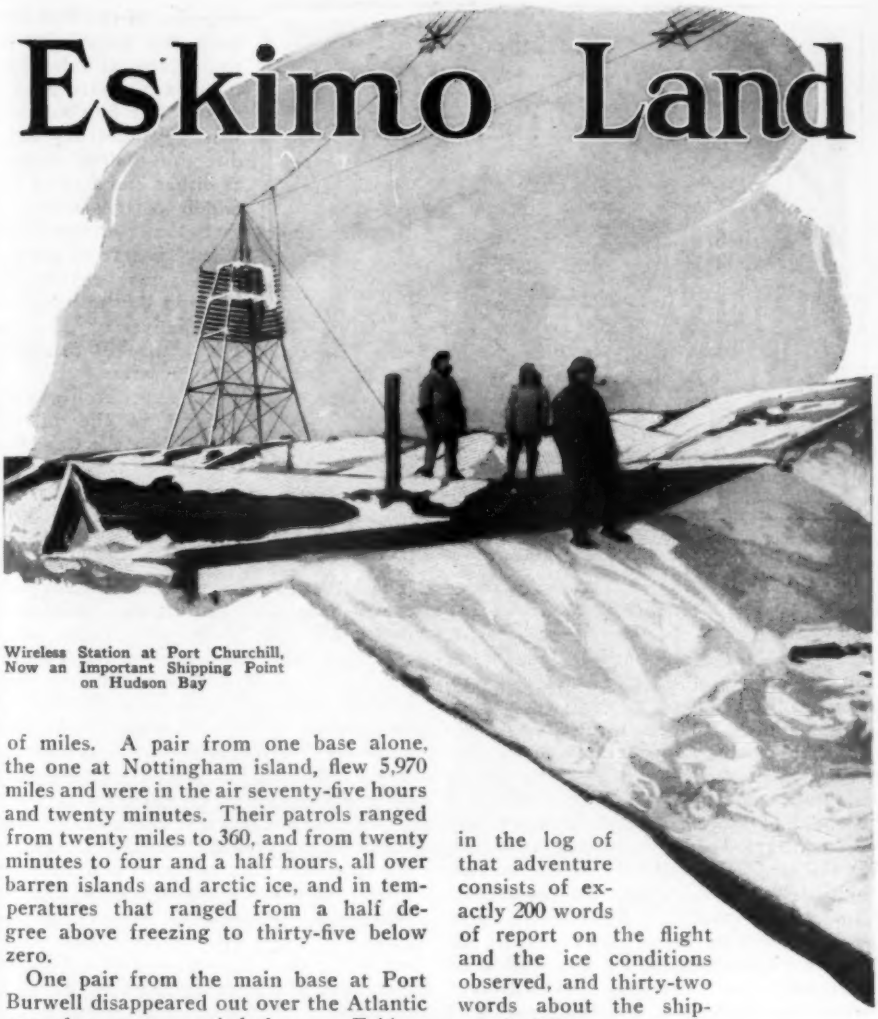
That was the aerial survey of the Hudson Strait expedition, which for one solid year rode herd from the air on the tossing icebergs that sail in endless procession down the 500 miles of waterway from the bay to the open Atlantic. From Port Burwell, in the lee of Cape Chidley, the northeasternmost point of Labrador, from Wakeham bay, midway of the straits, and from Nottingham island, which lies athwart the western entrance to that 500-mile ice-parade course, three groups of Royal Canadian Air Force pilots spent the winter of 1927 and the spring and summer of 1928 on ice patrol.

To get them in to those isolated stations, with their planes and hangars, stores and buildings, long and short-wave wireless sets and tall steel masts, and a base crew, complete from doctor to cooks for each of the three camps, and to take them out again the following year, with all their equipment worth salvaging, was a thrilling adventure that dragged out sixteen months long.

From the time the last steamers fled before the ice on Armistice day, 1927, until the supply ship returned on July 3 of the next year, the three little base camps in the Arctic were linked to civilization only by radio.

In that period, the flyers flew thousands

Eskimo Land



Wireless Station at Port Churchill, Now an Important Shipping Point on Hudson Bay

of miles. A pair from one base alone, the one at Nottingham island, flew 5,970 miles and were in the air seventy-five hours and twenty minutes. Their patrols ranged from twenty miles to 360, and from twenty minutes to four and a half hours, all over barren islands and arctic ice, and in temperatures that ranged from a half degree above freezing to thirty-five below zero.

One pair from the main base at Port Burwell disappeared out over the Atlantic one day, accompanied by an Eskimo hunter, and the three were not seen again for two weeks. The official log of the expedition dismisses that two-week adventure in one sentence. It doesn't mention the labor paddling a crazy rubber boat from ice floe to ice floe. It doesn't mention how they lived on the meat of a few seals killed by the Eskimo, or how he guided them for a week across the ocean, alternately walking and paddling, and then guided them another week across Labrador to the camp. The whole entry in the log of that adventure consists of exactly 200 words of report on the flight and the ice conditions observed, and thirty-two words about the shipwrecked flyers.

Under date of Feb. 17, 1928, the log says:

"Air Patrol No. A-11-A.

"Route of Patrol—north to Button islands, north to Resolution island, north-northwest up west coast of Resolution to Lower Savage island, north to east bluff on Baffin land, north over Baffin land to Grinnel glacier, south to Lower Savage island, south-southeast down west coast of Resolution island, south toward Port Burwell, east over mainland of Labrador,

Fashions and Figures from the Bay District; Indian Women, Here as Elsewhere, Have a Weakness for Garments of Bright Color

out over Atlantic ocean. Machine landed on ice in Atlantic ocean.

"Visibility five to fifteen miles.

"Considerable amount of open water due east in Atlantic as far as visibility, practically all open water in Gray straits. Number of large leads throughout whole width of straits, considerably more than on previous patrols. Leads much more numerous in the vicinity of Resolution island and around the island practically open water. Ice due west and southwest in the strait much denser as far as visibility permitted. East, ice conditions similar to vicinity of Resolution island, several icebergs being observed just off the west coast and the ice appeared to be extremely thin. Between lower Savage island and Baffin land practically all open water. Ice in Gabriel straits very thin. Around the coast of Baffin land all open water.

"Time in air—four hours, thirty minutes."

After walking over ice and paddling between ice cakes for one week in the Atlantic ocean, and walking over land for another week, the personnel of the aircraft reached their base safely.

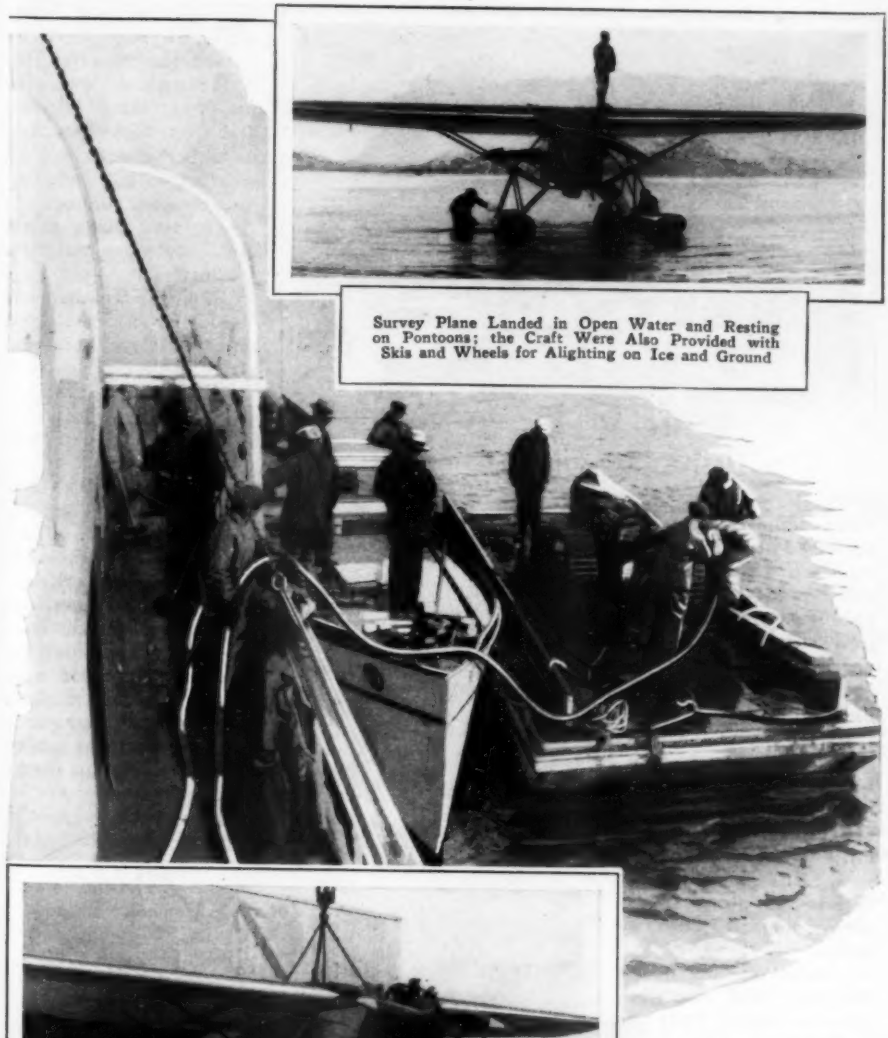
The logs of the "Stanley" and "Montcalm"—two Canadian government steamers, the latter an icebreaker, which were flagships of the fleet that took the expedition to the straits and brought it out again—are equally terse. They finished their work by erecting radio direction-finding stations at either end and in the middle of the straits, so that the procession of wheat boats expected next year, when the Hudson Bay railroad begins delivering grain to Port Churchill, can navigate in safety.

The expedition was organized in the fall of 1926, when the Canadian government decided to complete the railroad, which, started in 1910, had been halted during the war and gradually allowed to fall into ruin. Simultaneously it was decided to reopen the question of destination, and after the flyers went north in 1927, they learned the government had decided to abandon Fort Nelson as terminus, though $6,000,000 had been spent there on harbor works, and go on to Port Churchill, nearly a hundred miles farther north, because it offered a better harbor.

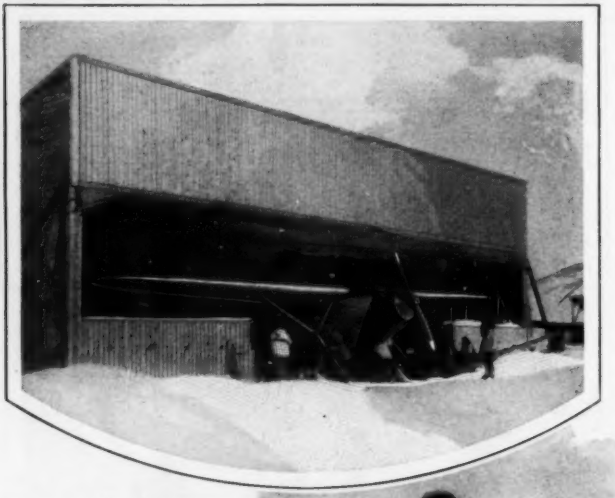
With no one resident at the straits save mounted policemen, Eskimos, factors of the Hudson's Bay company and Revillon Freres, a French fur company, and an occasional missionary, everything required by the flyers and base crews during their year in the Arctic had to be taken in. Lumber for houses, hangars, storerooms, power houses, radio plants and blubber houses, in which to store fresh seal meat, was cut, fitted and marked, all ready to be set up by crews of carpenters taken along for the purpose.

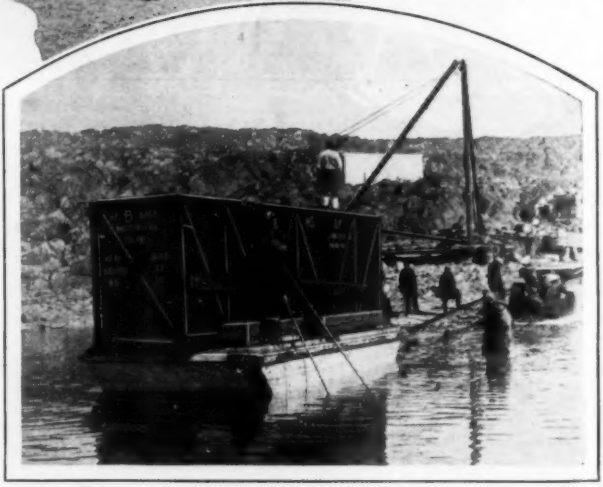
Some of the equipment required for each of the three base camps included two Fokker airplanes, complete with pontoons, skis and wheels for alternate forms of landing, and all necessary accessories and spares, the latter including one spare engine, one thirty-foot motor launch, one tractor, seven buildings, bricks, bags of sand, barrels of cement, long and short-

Survey Plane Landed in Open Water and Resting on Pontoons; the Craft Were Also Provided with Skis and Wheels for Alighting on Ice and Ground



Unloading Supplies; It Took an Ocean Freighter and Ice Breaker to Get the Materials to the Base, and Then Came the Task of Erecting the Buildings Including a Hangar Such as Shown at Left; the Expedition Required Two Fokker Airplanes, a Thirty-Foot Motor Launch, a Tractor, 160 Tons of Coal and Nearly 500 Drums of Gasoline, Oil and Kerosene, Besides Food for Sixteen Months





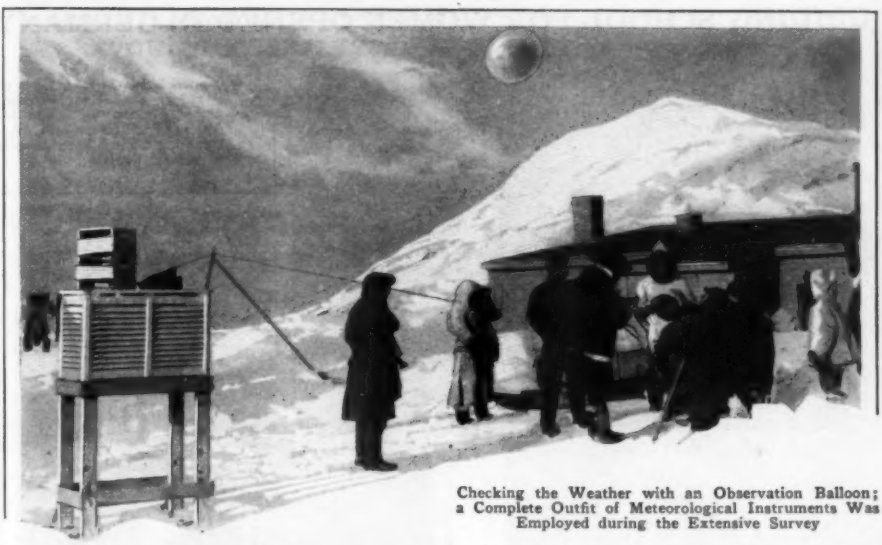
Plane in Its Special Hangar; Outboard-Motor Boat, and Pulling Supplies Ashore with Tractor and Barge

wave radio transmitters and receivers, two 150-foot radio masts, two gasoline engines to generate power, nearly 500 drums and cases of gasoline, oil and kerosene, 160 tons of hard coal, stoves, beds, bedding, clothes, food for sixteen months, two dories, one skiff, guns, rifles and ammunition, dishes and utensils, and meteorological instruments.

It took one big ocean freighter and one icebreaker each year to haul the supplies and men.

The tractors not only hauled the planes up the slipways out of the water, and over the ice in winter, but they also solved the problem of getting all the supplies landed, moved to camp sites and erected in the few short weeks available. Attached to stone boats—rough and heavy wooden sleds—they hauled the materials for buildings and radio masts up steep hillsides and over rocky beaches, usually working in weather so bad that frequently, for days at a time, small boats could not bring more materials ashore.

When the weather was good, the crews started after an early breakfast and frequently worked until ten or eleven at night, when an hour or two of dusk began to fall before the next day's sun came up. When the weather was bad, as it was most of the time, work was often impossible, and always dangerous. On one occasion, three men started to walk a few hundred yards back to the shore from a camp site at



Checking the Weather with an Observation Balloon; a Complete Outfit of Meteorological Instruments Was Employed during the Extensive Survey

Cape Hope's Advance, took a wrong turning and were not found until nearly noon the next day, though shots were fired and whistles blown throughout the night.

As the result of the aerial survey, Canada learned that the straits may be kept open to navigation for two months or more after the wheat harvest begins to move into Port Churchill. Hudson bay itself does not freeze in winter, save for shore ice extending out several miles, but Churchill harbor is closed about late October or early November, and the west end of the straits begins to close at the same time.

Stanch icebreakers are being built, however, to extend the open season and protect less able commercial ships, whose thin plates are always endangered by cracking ice floes. Ice and tides and barren rocky hills are so bad in the region of Cape Chidley that it will be necessary to refuel the icebreakers from tankers in one of the more protected harbors, as a land station is impossible.

From Hudson's little "Discovery" to wheat ships, and from the canoemen of the early voyagers to the "Iron Horse" at Churchill is a long step, but typical of Canada's progress since the war.

(The End)

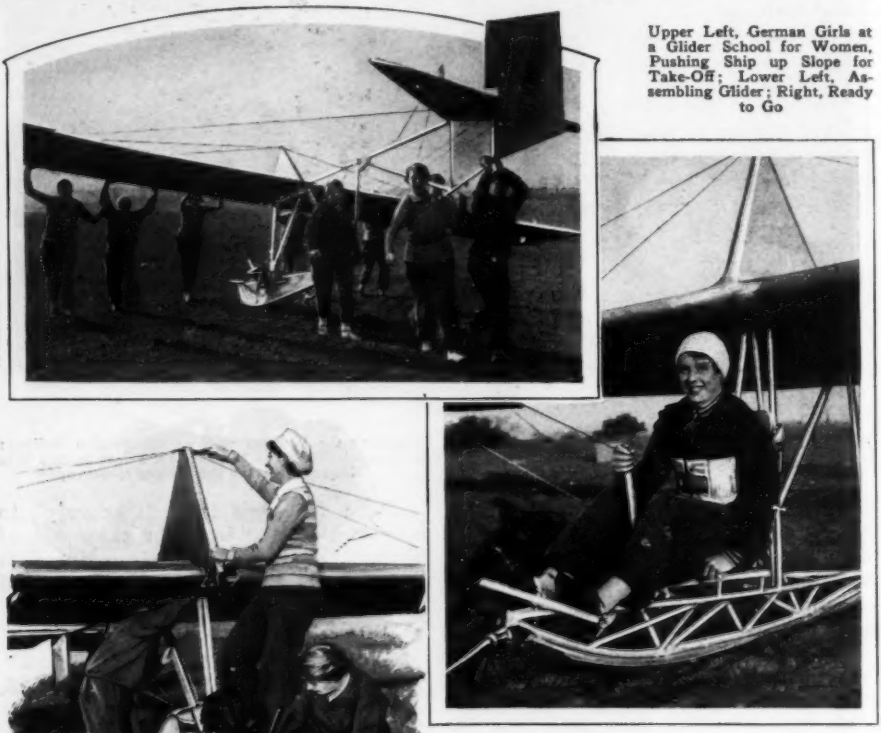
AIR-MAIL SHRINKS SIZE OF U. S. BY MORE THAN ONE-HALF

Measured in hours between points instead of miles, the air-mail service has reduced the size of the United States by almost two-thirds. By air mail the country now is only thirty-two hours wide, that time being required for carrying a letter from the Atlantic to the Pacific coast. Using as a standard a map representing the hours necessary to cross the country by fastest previous means and superimposing on it a map representing the air-mail hours, it is seen that a letter now may travel from coast to coast in the time previously required to cross the middle-western states.

Courtesy N. A. T.

Small Map Superimposed on Large One Shows How Air Mail Has Shrunk Size of U. S. in Hours

GLIDING SCHOOL FOR WOMEN OPENED IN GERMANY



Upper Left, German Girls at a Glider School for Women, Pushing Ship up Slope for Take-Off; Lower Left, Assembling Glider; Right, Ready to Go

Under the auspices of a national organization for the promotion of motorless flying, a gliding school for women only has been opened in Germany. Gliders for trial flights are furnished and the instruction is free. Because so many German women and girls have interested themselves in automobile driving and various forms of aviation, the glider school is expected to be popular as evidenced by early enrollment. Various tests are given the students until they are judged able to fly a glider alone.

FERRET FARM BREEDS ANIMALS TO EXTERMINATE RATS

Ferrets, cousins to the weasel and deadly enemies of rats and other rodents, are bred on an Ohio farm which boasts about 500 of these lithe little animals. Apartment houses in New York, wharves in San Francisco, grain elevators in Minneapolis, warehouses in New Orleans and boats in Boston harbor all have benefited by the activity of these rat exterminators. The animals are between eight and twelve inches long, with cream-colored, brown or black bodies, and sell for three dollars or more each. The ferrets are kept in pens and fed horse meat and a mush of ground wheat and milk. Because they also kill rabbits with even greater success than rats, some states have forbidden their importation entirely, and others prohibit the use of ferrets in hunting rabbits.

WINTER STOPPAGE OF BUILDING AVOIDED BY SHELTER

Construction work in winter may be carried on the same as in summer by utilizing the invention of a Berlin engineer who has made a weatherproof, portable shelter to cover the house under construction and govern the temperature. The walls of the shelter are made of a light wood frame which also constitutes the scaffolding. Into the framework water-tight plates of fireproof material are fitted, the joints closing of their own accord. Over the framework a simple tent roof is used, the shelter providing the same insulating protection from cold as a two-brick wall, and giving a temperature in which all building materials can be handled safely. As the shelter is portable and used repeatedly, the cost is small considering the advantage of being able to work in the coldest weather.

GLARELESS AUTO FLOODLIGHT HELPS ON TURNS

Providing a flood of illumination that lights the highway far ahead and both sides of the road without glare to annoy approaching drivers, an auxiliary lighting unit for the car now is on the market. It is attached to the crossbar between the headlamps, the reflector and lens intensifying and then spreading the light rays thousands of times, and casting a fanlike beam of light wider and farther than the ordinary driving lamps.

Glareless Auto Headlight Which Gives a Flood of Light to the Roadside on Sharp Turns

Paris Theater Which Has Four Movable Stages, Manipulated on Vertical and Horizontal Tracks

FOUR-STAGE THEATER CUTS TIME BETWEEN ACTS

Waiting time between acts is reduced to a minimum in a theater recently opened in Paris. It has four stages, each equipped with improved mechanical and electrical apparatus with which two men can control the entire show, one to run the switchboard and the other to manipulate the stages which move on vertical and horizontal steel tracks. Not long ago, a play with twenty-five acts was produced in the theater, employing all four moving stages.

CHINESE CAN BAMBOO SHOOTS

Bamboo shoots, regarded by Chinese epicures as a vegetable delicacy, now are being canned for export. The fibrous part of the shoot is first removed, after which they are boiled until they become tender, the taste being somewhat similar to that of some varieties of beans.

¶Tin in large proportions gives greater tensile strength to phosphor bronze, according to the British engineering standards association.

FLYING FASHIONS COMBINE UTILITY WITH BEAUTY

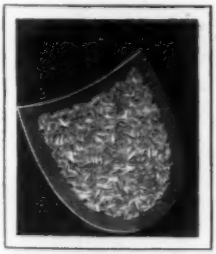
The Suit at the Upper Left Is of Blue Leather, Lined with Camel's Hair, and Has a Wide Turn-Up Fur Collar; to the Right Is a White-Suede Pilot Outfit Designed for Comfort and Style; for the Woman Who Does Not Care for a Complete Pilot's Costume, the Coat Lined to Match the Dress Is Offered, and a Comfortable "Cover-All" Suit Is Seen at Lower Right

HIGHEST POSSIBLE TIDE IS FIFTY-THREE FEET

There is great difference in the tides in the Atlantic ocean, the rise being greatest in the Bay of Fundy. The influence of the moon on the tides takes place in three distinct periods: the well-known month of the moon's phases from new moon to new moon; the period of the moon's distance from perigee, the point in the moon's orbit when it is nearest the earth, to apogee, the point when it is farthest away, and the month of the moon's declination north and south of the equator. The three periods differ in length and overrun each other. Under a combination of these conditions, each overlapping the other, it is possible for the tide to rise fifty-three feet, which is the extreme, apart from storm disturbances.

HARD-CENTER RUBBER HEEL IS EASY TO APPLY

Rubber heels that will hold regardless of where the nails are driven now are being produced. The heels do not differ in appearance from the usual type, but, instead of imbedded metal washers to prevent nails from pulling through, there is a plate of hard rubber mixed with either hair or oat hulls. The plate, which forms about one-third of the heel volume, is cured as an integral part of it, and can be made as tough as sole leather. It is cheaper to make than the ordinary heel and easier to apply, particularly in factories where machines are used for the purpose.



¶An English railway has fitted some of its trains with glass which ultraviolet rays penetrate.

Lines Like Those of an American Skyscraper Show the Modern Trend in Architecture in This German Church

CHURCH-ARCHITECTURE CHANGE SHOWS MODERN TREND

Churches, being erected in Germany today, are showing the modern trend in architecture, contrasting strangely with the long-famous Roman and Gothic cathedrals of the country and the baroque churches built in medieval times. One of the most modern is a Catholic edifice recently built at Frankfort whose vertical lines and columns remind of the American skyscraper type of architecture.

HOT AIR DRIES ATHLETIC FIELD

Rainy weather does not mean a wet athletic field at Purdue University unless it rains while the games are in progress. At the first sign of bad weather, big canvas sheets are placed over the field and staked to the sidelines, after which three commercial corn driers go into action and force hot air under the whipping canvas.

WHY NAVAL EXPERTS SAY THERE WILL NEVER

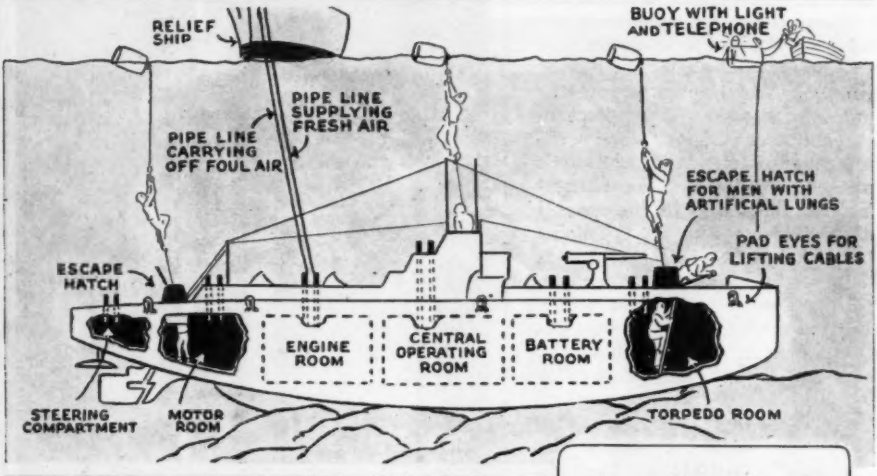
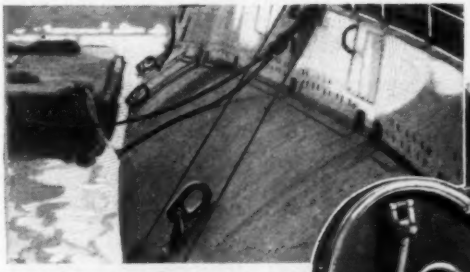


Diagram Showing Where the Various Safety Devices on the "S-22" Are Placed; Note the Location of the Several Special Escape Hatches

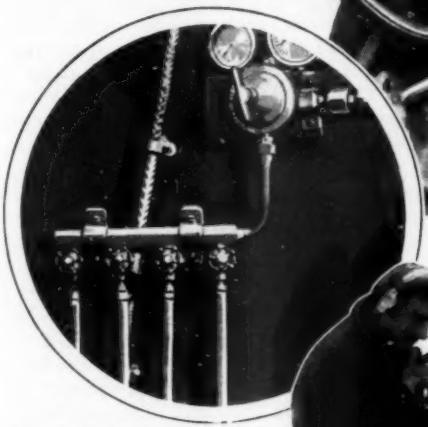
Lieut. H. B. Bell, Safety Officer of the "S-22," at Left, by Open Door of the Main Escape Hatch; This Is Used as a Ventilator for the Torpedo Room When the Ship Is Running on Surface; at Right, the Main Escape Lock with Man at Door, Which Is Used in Leaving the Submarine; This Lock Is Considered the Most Important of All the New Safety Devices for Underwater Craft

BE ANOTHER AMERICAN SUBMARINE TRAGEDY



Rings on Each Side of the Submarine for Connecting Pontoons; Each of the Six Is Tested to Stand a Lift of 160 Tons

Escape Hatch over the Motor Room in the Stern of the "S-22," Showing Lieut. Harold J. Walker, the Commanding Officer, Standing, and a Sailor Emerging from the Hatch



Oxygen Pipes in Main Escape Lock to Inflate Artificial Lungs Just before Men Leave the Lock and Start for the Surface

Lieutenant Bell Using Earphones and Telephone Transmitter of One of the Ships's Marker Buoys from Which a Boat on Surface Could Establish Communication with Helpless Submarine or Supply It with Lights; at Right, Close View of Buoy and Part of Its Equipment; the "S-22" Has Two of These Buoys Which Are Released Automatically in Case of Need

TOWER SUPPORTING FIVE TANKS USED AS OFFICE BUILDING

Three of Five Water Tanks Supported on One Tower, Which Also Contains Business Offices

Five circular water tanks are supported atop one eighty-foot concrete tower at Suffolk, England, where artificial silk is being produced. The lower floors of the tower are used for offices, and above them is a water-softening plant where the water is treated before being passed to the tanks for distribution to the plant.

SOIL IMPROVED BY HEATING

Soil is benefited and partly sterilized by applying heat to it, recent tests in England have indicated. Soils heated for half an hour at the temperature of boiling water were found to be free of pests and diseases and also to be more fertile and to produce healthier plants. Heavy soils required more heat than light ones, and while bacteria and fungi causing disease in plant roots were destroyed, the beneficial soil bacteria were not killed. The heat also caused complex organic and inorganic substances to be converted into simpler forms more useful for the plant and soil bacteria. Heating may be carried out either by baking the soil or passing steam through it, the latter method being the better. Heating must be thorough, as any center of infection will rapidly spread to the sterile sections.

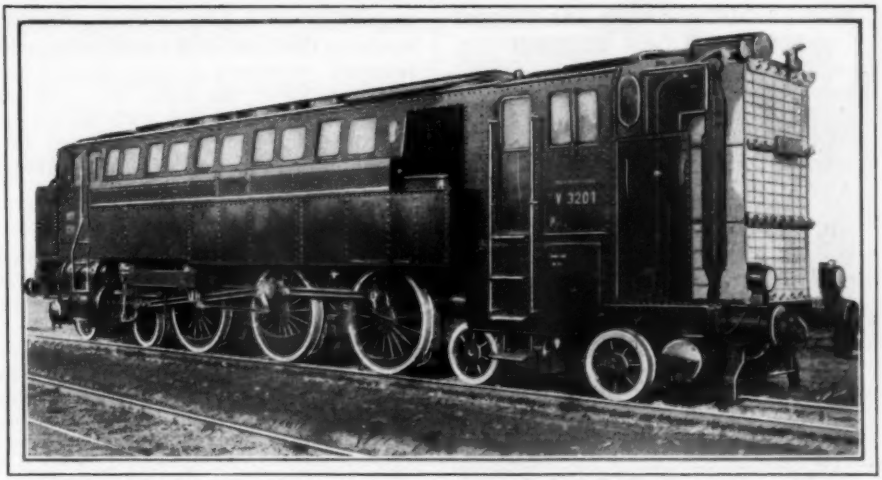
PROVE SUN CONTAINS CARBON BY MOTION PICTURES

Because movie producers wanted a film that would give night effects to pictures taken in the daytime, astronomers of Mt. Wilson observatory have been able to prove conclusively the presence in the sun of carbon. The movies, hunting for a way to make night scenes by day, found that photographs made by infra-red light gave a black sky, and a film bathed in a new dye, neocyanin, was found to acquire sensitivity to infra-red rays. The film was used for spectrum photographs of the sun, and showed spectrum lines corresponding to those for carbon from a terrestrial source. As the spectrum readings for the various elements never vary, the pictures proved the presence of carbon in the sun, the same as on the earth.

FROST SHIELD FOR CAR WINDOW GIVES CLEAR VISION

Affording clear vision in cold weather through frosted auto windshields or windows, a shield now is available for attachment to windshield, rear or side windows. The shield, in a metal frame lined with felt to create an air space between it and the window, is attached with vacuum cups.

Shields Attached to Windows with Vacuum Cups Prevent Frost from Obscuring Motorist's Vision



Diesel-Type Locomotive Driven by Compressed Air Which Is Heated by Exhaust Gases and Allowed to Expand in the Cylinders

COMPRESSED-AIR DIESEL ENGINE HAULS TRAIN AT LOW COST

Driven by compressed air, a large Diesel-type locomotive has undergone successful tests in Germany, pulling a train of 233 tons up a steep curved incline at a speed of more than twelve miles an hour. In previous types of Diesel locomotives, power was transmitted either electrically or by gearing, but in this case the engine drives an air compressor, the compressed air being heated in a compartment by exhaust gases from the engine and allowed to expand in the locomotive cylinders. The engine is operated more efficiently than either the steam or electric type, the combustion heat of coal being poorly utilized, while the electric type is costly. The compressed-air engine may be moved anywhere, being bound to no line or power station, and will complete a run of more than 600 miles without replenishing water or fuel, something impossible with the type utilizing steam.

PILOT'S FLARE TURNS ON ALL LIGHTS AT AIRPORT

By dropping a flare when he is from 600 to 1,000 feet above an airdrome on which he is descending, an airplane pilot automatically switches on all boundary, obstruction and floodlights. As the flare drops, it comes within range of a light-sensitive electric cell, set on top of a concrete pillar, three feet high, and controlling the airdrome lights. The location of the pillar is shown to the descending pilot by a triangle of colored lights. Two hundred feet away from the light cell, the lit flare causes a minute electric current to pass, and this is amplified in a series of relays until a powerful current travels through the airdrome and switches on all the landing lights. The lights can be turned off by another switch.

RUBBER CARPET WITH HAIR NAP FOR FLOOR OF AUTO

Intended for use on the floors of automobiles as well as in the home, a rubber carpet with a wear-resisting hair surface now is being produced. The material consists of a layer of flexible sheet rubber over which is applied a thin layer of rubber and hair mixture. The layers are cured into one piece, and a scratch brush is run over the surface to remove the rubber and cause the hair to be exposed, producing a finish similar to that of a carpet.

MOVIE OUTFIT FOR SALESMEN HAS BUILT-IN SCREEN

Portable Movie Projector with Built-In Screen, Permitting Salesmen to Display Their Products

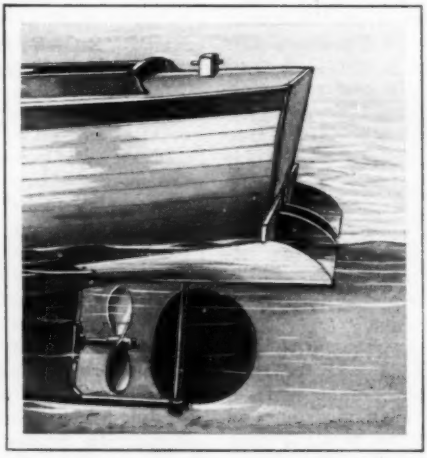
Salesmen now may carry their own movie outfits to demonstrate their products at the desks of their customers. A portable movie projector, weighing but nineteen pounds and contained in a compact case, has been designed particularly for the salesman, although it can also be adapted for the home. It is equipped with a self-contained screen, thus requiring no preliminary preparation aside from opening up the case and plugging into a light socket. If power is unobtainable, a model is available that is cranked by hand and illuminated from a six-volt battery. For an audience of more than three or four persons, the built-in screen in the front of the machine may be removed, permitting direct projection to a larger screen on the wall. The case has space for 800 feet of film, with the projector containing another 100-foot reel, sufficient for more than a half hour's running.

FUEL OIL FROM NUTS

Oil of the babassu tree, a little-known member of the cocopalm family, besides comparing favorably with other edible vegetable oils, has a high value as a source of fuel oil. Ships of the Brazilian navy were fired with oil of this kind during the World War when there was a shortage of fuel oil. The tree and its products serve the natives of northern Brazil as food, shelter, clothing, fuel and illuminant, and it is also used in the curing of rubber because of the properties of the smoke from its burning nuts.

SUCTION ELIMINATOR FOR BOAT INCREASES ITS SPEED

To increase the speed of the modern power boat by getting rid of the suction astern, the fishermen of Provincetown, Mass., have installed suction eliminators at the stern of their craft. The device somewhat resembles a wooden scoop and consists of a wedge-shaped box open at the top, made of seven-eighths-inch planking about eight inches long and of a width corresponding to the proportion of the waterline of the craft to which it is attached, usually from three to four feet. The suction at the stern causes the boat to settle deep in the water, but the eliminator allows the stern to ride high, because the waves, instead of curling in toward the craft, sweep out from it.



Wedge-Shaped Scoop above the Propeller, Which Eliminates Suction Astern a Power Boat

RADIO YARDSTICK TO ASSURE BETTER RECEPTION

Functioning with an exactness of better than one part in 1,000,000, a radio yardstick has been designed by the bureau of standards for measuring the frequencies or wavelengths of the 600 broadcasting stations, 16,000 amateur stations, and other radio transmitters. It will detect broadcasting stations that are wabbling, or straying from their assigned wavelengths, and it means improved reception to the estimated 10,000,000 listeners. This new radio yardstick consists of four miniature transmitters. The heart of the instrument is the quartz crystal or mineral, which acts as a governor of the transmitters. Heretofore, these slabs of minerals have been cut in disk, or other, shapes, but here they take the form of rings. Tests have shown that ring-shaped crystals are least subject to variations of temperature and, therefore, are more constant and precise as governors of radio wavelengths or frequencies. The crystal governors are further protected from moisture and pressure variations by inclosing them in a bell jar, at a pressure slightly below atmospheric. Also they are covered by a shell of aluminum, with a wall one inch thick. The wall holds a heater and a thermostat element.

THERMOSTAT IS EASY TO FIT ON ANY AUTO

A thermostat, entirely automatic in operation, is now on the market. It is installed in a few minutes as an integral part of the engine, and regulates the temperature of the cooling system without further attention or adjustment when set in the required position. It is intended for use on cars which are not so equipped and is particularly useful during cold weather.

¶Switzerland develops so much more hydroelectric power than it needs that in the last year it exported over one billion kilowatt-hours.

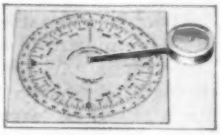
Untreated Metal Plate on Which Photographic Impressions Have Been Made in Broad Daylight

PHOTOGRAPH ON METAL PLATE IN BROAD DAYLIGHT

Based on the discovery that metals record impressions from streams of electrons and that these impressions can be developed, an appliance has been invented for photographing pictures directly on untreated metal. The advantage of the discovery lies in the fact that the metal plates will record the image projected upon them in broad daylight.

COURSE AND DISTANCE FINDER FOR BOATS AND PLANES

Combining a transparent compass and a tape scaled to a chart, a course and distance finder for the use of ships and airplanes now is on the market. The compass dial is centered over the position of boat or plane, and the tape is drawn across the center of the compass to any desired position on the chart beneath the transparent compass. The course is read on the compass dial, and the distance is computed from the tape scale.



Off for the Daily "Weather Hop"; a Navy Plane with Observers Aboard, Gathering Data for Reports on Wind, Temperature and Other Conditions near a Naval Air Station

By CALVIN FRAZER

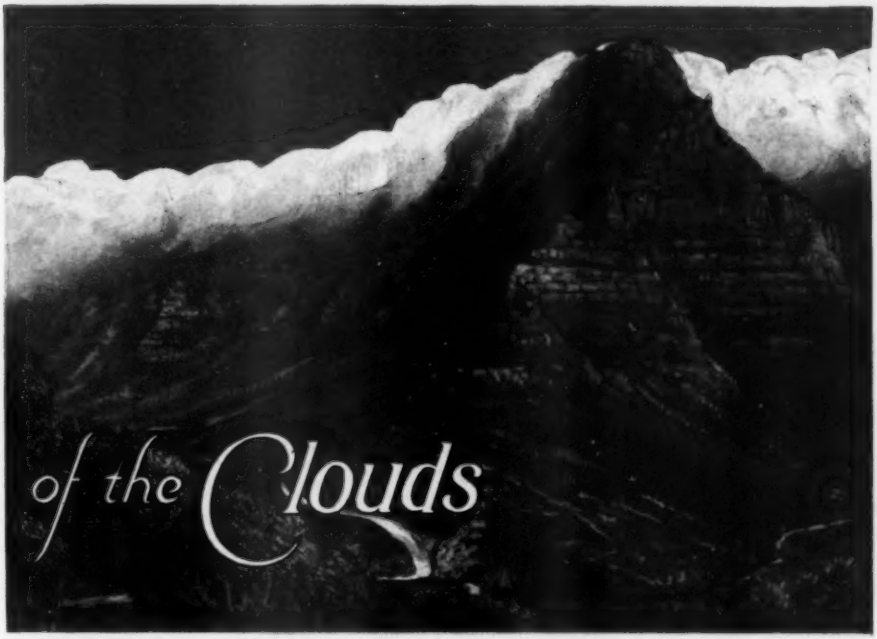
TO OUR grandfathers the clouds were interesting mainly as indicators of coming weather. They, and their ancestors for ages before them, sought in the aspect of these vapory masses portents of rain or fair weather, stormy winds or gentle breezes. Such popular maxims as

"Mares' tails and mackerel scales
Make tall ships carry low sails"

were current in the world long before science began to call mares' tails cirrus and mackerel scales cirro-cumulus, or had acquired any real knowledge of clouds not possessed by humanity from time immemorial.

About a generation ago, science began to seek information of another kind from the clouds. It was recognized that through their systematic observation much might be learned about the circulation of the earth's atmosphere; not merely at the surface of the earth but at various higher levels. A cloud is a natural weather vane of the upper air. It shows the direction of the wind by which it is drifted along, but it does not show the height of this wind or its actual speed unless the height of the cloud is known.

As a means of exploring the entire wind system of the globe, elaborate plans were laid for making daily measurements of the heights and the movements of clouds, by uniform methods, at a number of meteorological observatories in different parts of the world. The observations were carried on for a year, beginning May 1, 1896, and the enterprise is generally referred to as the "International Cloud Year." It furnished the basis of what is now known about the upper winds and also about the relative heights of the different types of cloud, from the lofty cirrus, which has sometimes been observed at an altitude of twelve miles within the tropics, down to the low stratus, which is merely an elevated fog and often merges into ordinary fog lying on the earth's surface. In general, clouds of all types were found



One of the Most Famous Cloud Formations in the World; the "Tablecloth" Spreading over the Top of Table Mountain in South Africa

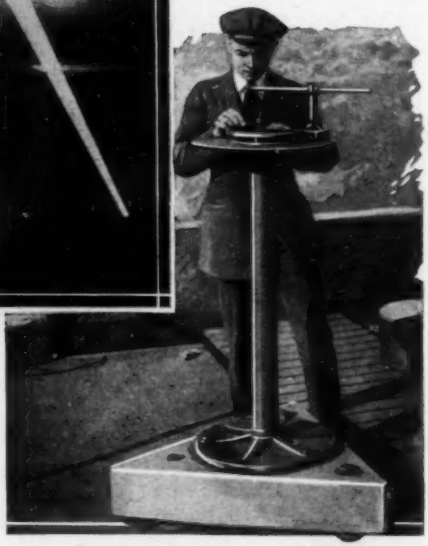
to be higher in summer than in winter, higher over deserts than over humid regions, and higher in low latitudes than in high latitudes, being lowest of all in the polar regions.

A third stage in the observation of clouds has lately been entered. There are now hundreds of places in this country and abroad—and there will soon be thousands—where clouds are observed several times a day, not primarily for the sake of getting a line on future weather changes nor as a means of learning how the winds blow aloft, but in order that aviators may be advised of the presence and height of clouds occurring at flying levels. Such clouds, which generally limit the height to which a plane may safely fly, are known to aviators as the "ceiling."

Still other observations of clouds are made for the purpose of learning their mode of origin, their structure, the sizes and numbers of water drops or ice crystals they contain, their capacity of reflecting and absorbing light and heat, and so on. Lastly, one of the big tasks of climatology is to determine the distribution of cloudiness over the globe and the variations to which it is subject. Many meteorologists specialize in cloud studies and there is an international commission on this subject, headed by the director of the French meteorological service.

How does science study the clouds? First of all, there is the problem of measuring cloud heights and this is solved in a great variety of ways. The most exact methods involve simultaneous measurements of the angular elevation of some part of a cloud, as sighted from the ends of a measured base line. From the data thus obtained the height of the cloud is worked out. Less precise measurements can be made by a single observer with the aid of a range finder, such as is used by artillerists.

In a mountainous country, the mountains, if their heights are known, serve as measuring sticks for determining the heights of clouds enveloping their sum-

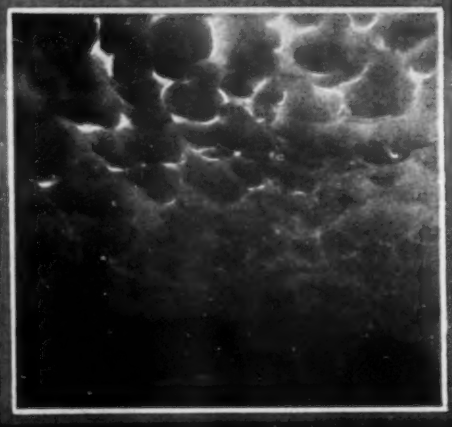


mits or extending down their slopes. The height of a cloud overhead can be measured by releasing a pilot balloon, which ascends at a known and constant speed, and noting the time elapsed before it enters the base of the cloud. Cumulus and cumulo-nimbus clouds —popularly called "woolpacks" and "thunderheads"—are formed by the cooling and condensation of moisture in ascending air currents. The base of the cloud marks the level where condensation begins, and its height can be calculated somewhat roughly from the temperature and humidity of the air at the earth's surface.

At flying fields, the height of low clouds is measured by night, and sometimes by day, with a special form of searchlight, known as a "ceiling light." This throws a beam on the cloud at an angle of forty-five degrees to the horizontal. The observer paces off the distance from the searchlight to a point directly under the spot of light on the cloud, and this distance is equal to the height of the cloud.

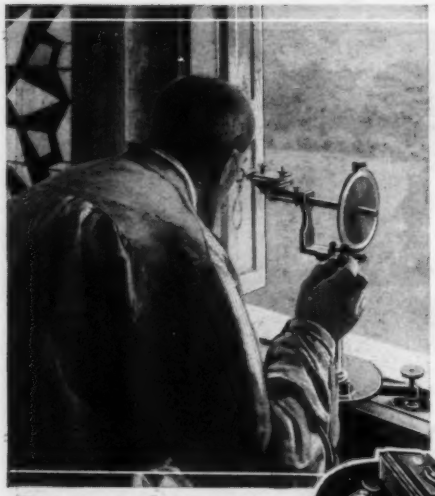
One of the routine tasks of weather observers throughout the world is to note the direction in which the clouds are moving at the observation hours. In most cases no instruments are used, but certain precautions must be taken to get the true direction, unaffected by perspective or other sources of error. For exact determinations it is necessary to use one of the various instruments known as "nephoscopes." These are made in numerous patterns, but they all fall into two general classes: reflecting nephoscopes and direct-vision nephoscopes. In the former there is usually a horizontal black mirror, with compass points or degrees drawn on the mirror or on the surrounding frame, together with an adjustable rod projecting above the mirror. The rod serves as a fixed point for noting the direction in

Top to Bottom, Measuring Cloud Heights with a Theodolite; Ceiling-Light Measurement, and Observing Cloud Movements; the Ceiling Light Is Widely Used at Airports



Jove's Anvil Forging Thunderbolts; a Splendid Example of Cumulo-Nimbus Clouds, Photographed in Spain; at Right, "Pocky" Clouds Which Usually Indicate Approaching Thunderstorms; the Sacklike Protuberances Have an Odd Look of Being Upside Down; Such Clouds Usually Mean Strong Winds and Sudden Changes

Cirrus Clouds Often Resemble the Markings of a Painter's Brush and Usually Form at High Altitudes; They Are Frequently Composed of Tiny Particles of Snow or Sleet and Sometimes Give Graphic Evidence of Wind Currents

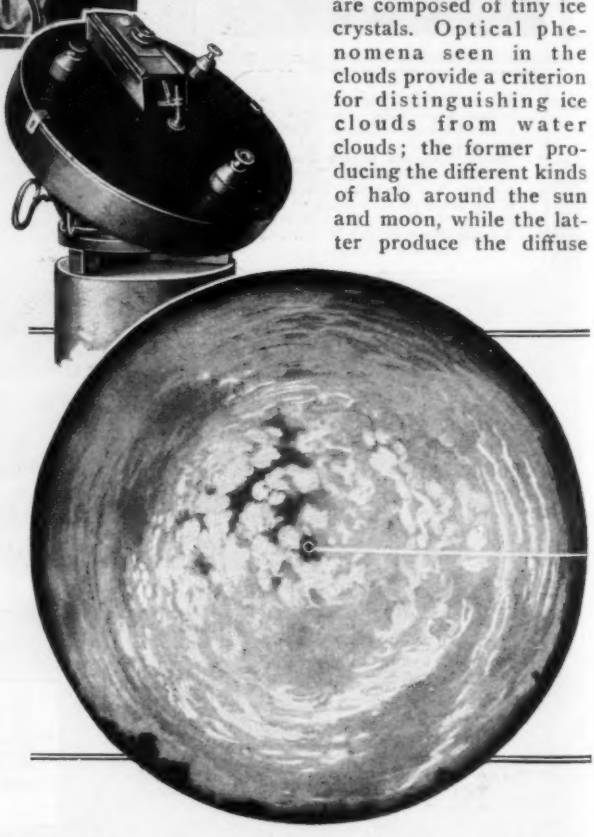


which the image of the cloud moves across the mirror.

The best known direct-vision instrument is Besson's "comb nephoscope," widely used in Europe. This consists of an upright brass rod about nine feet in height, with a horizontal crosspiece at its upper end. The crosspiece bears a row of equidistant spikes. The observer stands a few feet away from the instrument and rotates the rod by means of a pair of cords until the cloud that he is observing appears to move along the row of spikes. Its direction of motion is then read from a graduated circle attached to the base of the rod.

In recording cloudiness, the observer notes the fraction of the sky, in tenths, covered with clouds, without regard to the thickness of the latter. Such observations are usually made without instruments, but there is a device called a "nephometer," consisting of a hemispherical black mirror ruled in sections, with which cloudiness can be observed with special accuracy. The reflection of the sky in this mirror is viewed from two or more angles, through a movable eyepiece, so that the whole sky may be observed. Another instrumental device is a revolving camera which photographs the whole sky on one plate, thus making a permanent record of both cloudiness and the kinds of cloud present.

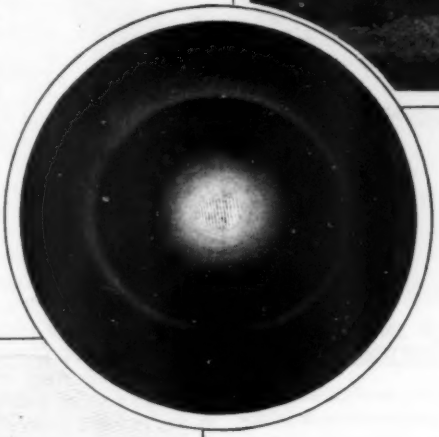
One of the most remarkable facts about clouds is that, with the exception of the fibrous types (cirrus and cirro-stratus), they always consist of unfrozen water drops, even in the coldest weather and in the polar regions. The fibrous varieties are composed of tiny ice crystals. Optical phenomena seen in the clouds provide a criterion for distinguishing ice clouds from water clouds; the former producing the different kinds of halo around the sun and moon, while the latter produce the diffuse



Measuring Cloud Movements by Reflections in Pool; a Revolving Cloud Camera, and One of the Photographs It Takes; This Instrument Permits a Study of the Cloud Formations in All Parts of the Sky

luminous rings called "coronas" and certain kinds of iridescence. Information obtained in this way is confirmed by the direct observation of mountaineers and aeronauts, who have examined the different kinds of cloud at close range.

Since water is a comparatively heavy substance—and since, moreover, raindrops are seen to fall rapidly—most people are puzzled by the fact that a cloud "floats on high o'er vales and hills." Wordsworth's line does not describe the process with scientific accuracy, as clouds do not actually float, but the minute particles of which they are composed settle down very slowly against the resistance of the air, or are borne aloft by slight upward air currents. The speed with which a drop falls through the air increases with its size and an average cloud droplet is only something like one eight-hundredth of an inch in diameter. Millions of such drops must be combined to form an ordinary raindrop.



Nephometer for Measuring Degree of Cloudiness; How Sun Looks through Cloud of Ice, and Comb Nephoscope to Record Cloud Speed

Mountains are responsible for several other striking varieties of cloud, including so-called "cap clouds," "banner clouds," and "crest clouds." Some of these form so often on particular mountains that they have acquired individual names. The most celebrated example is the sheet of cloud that spreads at times over the flat top of Table mountain, in South Africa, and dangles in a vertical fringe over the leeward edge. This has been known for three hundred years as the "Tablecloth."

LIFEBOAT FOR PLANE RESCUES IS WORLD'S FASTEST

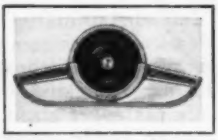
Intended primarily for going to the rescue of airplanes coming down at sea, the world's fastest lifeboat has been stationed at Dover, England, where there is heavy daily passenger airplane traffic as well as steamer traffic. The motor lifeboat is sixty-four feet long, has two engines, each of 375 horsepower, and a speed of seventeen to eighteen knots.

Somewhat Resembling a Houseboat, This Floating Church Carries the Gospel to Many Out-of-the-Way River Hamlets in Germany

FLOATING CHURCH IN GERMANY TRAVELS WATERWAYS

Traveling from town to town along the numerous waterways of Germany, a floating church, similar in construction to a land edifice except that it is built on a boat, brings the gospel to many out-of-the-way hamlets. The church, complete even to bell and spire, somewhat resembles a huge houseboat, except for the features marking it as a place of worship.

TOY WAGON IS MADE INTO SLED BY ATTACHING RUNNERS



Sled runners which may be attached to the wheels of the toy wagon to transform it into a vehicle for winter sport now are on the market. The runners are easily fastened to the wheels or detached from them, and, when in place, the wagon steers in the same manner as when the runners are not attached.

TREE-FIRE MYSTERY SOLVED BY PLANT DETECTIVE

The telephone in the trouble department of the public-service company, Camden, N. J., rang repeatedly. A huge tree, through which high-tension wires passed, was smoking and obviously was afire. The trouble crew hurried out to examine the insulation on the wires passing across the top of the tree. It was found to be intact—yet the tree smoked. Finally Dr. Rodney H. True, director of the botanic gardens of the University of Pennsylvania, was called and explained the mystery.

The tree was a paper mulberry, of the male species. Now, this tree, explained Doctor True, is not content with allowing its pollen to drift off, as is the case with most trees, but "shoots" it out in little powdery puffs. These little explosions, and the resulting clouds of pollen gave the tree the appearance of sending off smoke. So the mystery of the burning tree was solved, and in a few days, when the season of pollination was over, there were no more "trouble calls." This was only one of many interesting experiences by the botanist, for time and again the engineers of large plants call on him for expert advice. Recently a large oil plant in southern New Jersey was sued by the owners of adjoining farms, who claimed that the water pumps of the company were draining their farms, from below, creating an underground desert as it were. It was obvious that the crops had suffered, but whether or not it was the fault of the oil company's pumps was the question. Now it is an established fact that the rings of growth on the cross sec-

tion of a tree trunk show whether or not the season of growth was one of abundant water supply, for in years of drouth the rings are not so thick. Doctor True had a number of trees cut down in the section, and studied them for the periods before and after the establishment of the oil plant. From his observations, he showed that the company pumps were not draining the land, but that leakage from an old oil tank, years before, had affected the trees which showed stunted growth.

BLUE VITRIOL DESTROYS WEEDS BUT SPARES SMALL TREES

Bluestone, better known as blue vitriol, has been found an efficient destroyer of weeds in a bed of conifer seedlings because it does not harm the small trees. Eight grams of bluestone dissolved in water and sprinkled over one square foot of ground kills practically all varieties of weeds but does not interfere appreciably with germination of the seeds and the growth of the little trees.

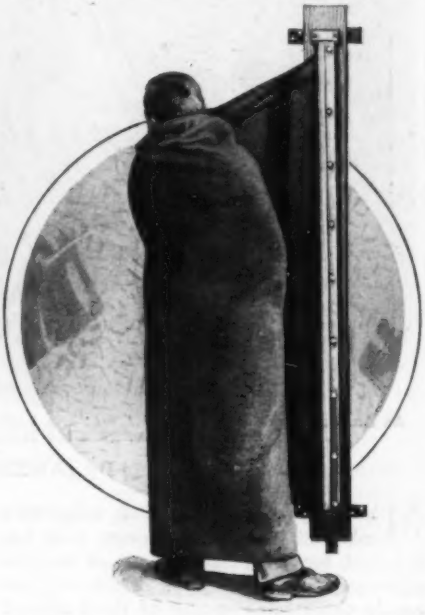
COMPOSITION-RUBBER DESK PAD DOES NOT BLOT OR STAIN

Made of flexible composition rubber in various color combinations, a desk pad that does not blot, stain, or collect dust and lint like the ordinary blotter pad now is on the market. Ink does not stain it and a burning cigaret leaves no scar. A single sheet of paper lies firmly on the pad, making writing with one hand easy, so that the other hand is free to hold a telephone receiver or perform other tasks.

Composition-Rubber Desk Pad Grips Paper Firmly and Does Not Stain from Spilled Ink

FIRE BLANKET HELD ON FRAME IS QUICKLY DONNED

Supported on a roller on an upright frame, an all-woolen fire blanket, virtually fire and moth-proof, now is available to be placed where fire hazards are present in an extra degree. The blanket, wide enough to enfold a large person and long enough to cover the body, is always ready for use, and is donned in a moment by snatching a catch rope and unwinding it from the roller, at the same time wrapping it about the body. It detaches from the roller automatically.



Fire Blanket, Held on Rollers in an Upright Frame, Used to Run through Flames

ABANDONED AUTOS FILL IN BAY TO MAKE AN AIRPORT

Officials of the Borough of Queens, New York, have found a use for abandoned automobiles. Ten thousand old cars have been dumped into Bowery bay to riprap the foundation for extension into the bay of the North Beach airport by 500 feet. The old cars were found to be almost ideal material for this purpose.

An American Spy during the World War in a Lookout in a Tree; He Is Equipped with Headphones Connected to German Lines and Is Listening for a Possible Enemy Secret

By JAMES N. MILLER

MYSTERY, intrigue and adventure abound in the true stories, now being told for the first time, about the exploits of world-war spies. Until very recently these tales—many of them almost beyond belief—have been kept under lock and key in the government's secret files at Washington.

One of the cleverest spies operating in America was a woman in the employ of the German government. She had been suspected for some time but no direct evidence could be lodged against her. Finally she was arrested by army intelligence officers and searched. An unusually large number of pins was discovered in her garments. A cipher expert examined them and found curious marks scratched on the heads of the pins. The little marks proved to be a code which was finally deciphered. The woman had been carrying important messages in this manner for weeks.

Another story concerns radio messages in code which were sent from German warships and recorded on a phonograph disk by the British admiralty. The men assigned to decode the communications were baffled. All they could hear when the records were played was an unintelligible gibberish that defied translation. Then a lucky accident led to the solution. A tired agent let his phonograph run down one day. Suddenly he jumped to his feet. The message was being spoken in plain German! The slowing down of the instrument had made the talk understandable. The Germans had made records of their messages and sent them through the ether at terrific speed, but the slow phonograph had betrayed them.

In another case, a woman spy devised a 3,000-word report in such a manner that she could paste it on the lens of her spectacles. Also, a dancer dining in a Paris cafe waved her fan in certain fashion, spelling out a message that led to the sinking of a French transport off the coast of Morocco.

A German spy jumped from an airplane, landed in a British camp in British uniform and immediately ordered other officers to collect information for a projected British attack. Another German spy was so active that the British were compelled to send several warships and several thousand troops to stop his plans and capture him.

That world-famous authority on the

Adventures of Spies

various methods of espionage, Maj. C. E. Russell, says graphically:

"Secretly and alone, the man from the espionage service fights a single-handed battle. He makes his way behind the lines of the enemy, his brain pitted against the combined brains of the enemy's secret service. The stakes for which he plays are the highest in the world—the lives of thousands of his fellow soldiers, and potentially at least, the welfare of the loved ones at home. Yet, in the face of all this responsibility, he carries on, knowing full well that the reward is at best meager. There are no medals of honor, the general's quiet nod of approval being about the utmost that can be expected."

Top, Receiving Code Message from Spy in Enemy Lines; Below, Bomb-Proof Code Station Used by German Spies

Concerning how our spies got through the enemy's lines in the late war, Major Russell explains that three principal methods were employed, all of which were useful only if the secret agent had an expert speaking knowledge of German and developed painstakingly the traits of observation and memory. The first ruse was to adopt the uniform of the enemy, usually that of an enlisted prisoner, and fight one's way through by day. The second was to go over in the blackness of night, and, remaining hidden by day, listen to all that could be overheard, and

An Underground Trench Station during the World War as Preparations Are Being Made to Send a Cipher Message

witness, by means of unusually powerful field glasses, all that might be seen. The third, and supposedly the best procedure, was to gain permission, by way of a neutral passport, to travel unhampered from place to place.

Communication between spies and their chiefs was accomplished by a wide variety of methods. Wireless telegraphy, of course, was the most common, and it ultimately led to the perfection of a spy-proof code cipher. It is a modification of the crossword puzzle. A key is employed, consisting of a number of squares in each of which are all the letters of the alphabet. Over these squares is laid a piece of tracing paper and a line is drawn from letter to letter, back and forth, spelling out the message. Then the zigzag picture is wirelessed as a single unit. The job of the man on the receiving end is to transfer the zigzags to transparent paper, place them over his key and then untangle the message. To wireless such a picture or map requires two cylinders of the same size, revolving at a predetermined speed in perfect synchronism. Size and speed can be varied at will, a fact that makes for the safety of the code, even though the key be stolen.

Invisible inks of various compositions were used widely in writing messages on sundry articles of clothing. Even bandages and the insides of trunks were utilized for this purpose. The famous "petticoat case" is known to intelligence officers of practically all the nations engaged in the late war. It seems that a famous opera singer had just completed a concert tour of France and was returning to Switzerland. Her presence did not create particular excitement, until one of the custom officials noticed that she wore a thickly starched petticoat that was absurdly out of style. His suspicions aroused, the official ordered one of his woman aides to have the petticoat examined. Whereupon the garment was given the "acid" test and a message revealed.

Strangely enough, perhaps the most common chemical used by spies in writing invisible reports is ordinary lemon juice. It dries readily and later on, when heat is applied, the writing stands out bold and black. The kind of paper preferred is onion skin, since it is very thin and strong and is readily compressed within a surprisingly small space.

Wrapping paper was also used to a considerable extent as a message purveyor, for the reason that it did not tend to arouse suspicions if the paper was tied

One of the Spy Centers of the American Forces during the World War; This Is a Standard Code Center Which Received Messages from American Spies in the German Lines

around an innocent article like bread, or perhaps a book. Books themselves were employed, especially those with wide spaces between the printed lines. Newspapers with broad margins also were used. Various acids, which possessed the virtue of revealing maps or messages only when water was applied, were tried out with success. A case in point is the well-known "bathtub affair," which caused many a smile to secret-service officials. A rather stupid-looking fellow, claiming to be a neutral, was trying to get through France to Germany. Held for observation with a group of other men, he was asked to take a bath. He refused point-blank, even though he admitted that water had not bathed him for over a week. Willy-nilly, he was showered liberally with water, with the result that on his back was found an important message for the enemy!

Still another invisible-writing method was made possible by the micro-pantograph, a device actually able to write a complete message on tiny pieces of glass and metal. Even the head of a pin or needle, eyeglass or tip of fountain pen was utilized. Needless to say, it was impossible for the human eye to detect the ruse, the only means of discovery being a high-powered microscope.

Besides these written means of communication there was employed the so-called visual method which used natural or customary objects or actions to convey messages to the enemy. An ingenious fellow was the Alsatian with his flock of sheep. For several months he was in the habit of pasturing his animals in the rear of a French division. By dividing his flock into three parts and letting them feed in different fields, he had many combinations to use in telling the Germans in their observation balloons and planes what was being planned by the French.

The three groups in three fields meant there was nothing of importance to report. Two flocks in the right field and one in the left meant, "look out for activities on the left front"; when all were in one flock, the French were concentrating on an attack in the center; whereas when all were in the farthest field, the

Army Officer Sending a Code Message; It Was over Equipment Such as This That Much of the Information from American Spies Was Received and Transmitted during the World War

French had withdrawn troops from that sector. After repeated failures of their secret plans, we are told by Major Russell, the French discovered the farmer and his sheep.

Hardly less clever was the Belgian who used the arms of his windmill to signal the German aviators the plans of the Canadians. A young Canadian officer in an idle moment happened to be drawing a picture of the mill when he was astonished to discover that the arms were moving against the wind. This continued for over an hour, so the officer reported his discovery to his superior. Very soon the Belgian was captured, and confessed, furnishing the Canadians with his code. Utilizing their knowledge, the Canadians surprised the Germans. The signal was given, "Troops withdrawn," with the result that the enemy walked into a trap.

Then there was the instance of the French peasant woman who seemed always to be spinning outdoors when the Germans flew their planes overhead. She had her yarn running through a shutter of the house, and as she spun she manipulated the shutter, thereby sending code messages. Suspicions were aroused because her house, though in the danger zone, was never fired by airplane bombs.

Major Russell believes that in the event of another war, many new inventions will be used to advantage for signaling. In this connection, invisible light is opening a new field of secret communication. Infra-red rays, the long light waves which ordinarily produce no color sensation, can be employed in military signal lamps for flashing signals which can be seen only by observers using a special screen.

WHISTLE OPERATED BY SWITCH

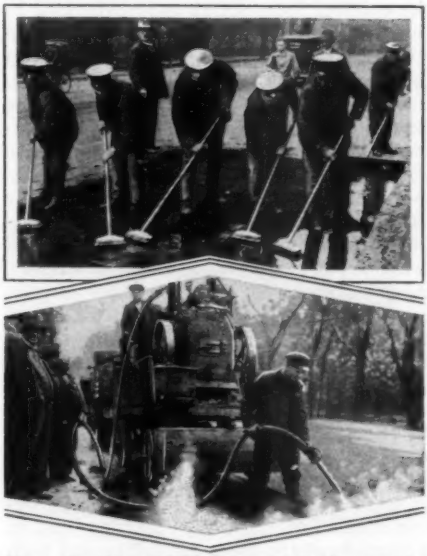
For the protection of workmen, a mining company has installed a whistle connected to the switch and also to a compressed-air line. When the switch is thrown to direct a train of cars into the crosscut, the whistle is blown automatically, thus warning all workmen of the approach of the train.

RAIL JOINTS ARE KEPT TIGHT BY MOLTEN METAL SPRAY

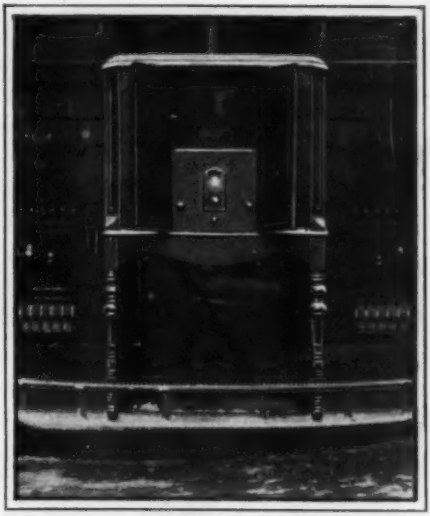
Electric railways, faced with the heavy expense of tearing up pavements to tighten loose rail joints, are interested in a process which has been developed to keep them tight indefinitely. The inventor of the process worked on the theory that the rails were not loosened by vibration but by rust and mill scale at the rail ends. The permanent-tightening process involves the spraying of molten metal at the connections, compressed air being used to blow a fine mist of molten metal over the entire area to be assembled. Brass, zinc, copper, steel, chromium, nickel or any other metal may be used for the plating.

OIL REMOVED FROM STREETS WITH STEAM AND BRUSH

Tests are being made by Berlin officials in fighting the menace of slippery streets which are blamed for many automobile accidents. Steam has been used to remove the slippery oil from some thoroughfares, while elsewhere city employes have been equipped with scrubbing brushes and powder to eliminate the film.



Above, Scrubbing Oil Film from Berlin Streets; Below, Using Steam for the Same Purpose



Gigantic Radio Receiver Outside a Cleveland Building Which Broadcasts Luncheon Programs

RADIO RECEIVER TEN FEET HIGH BROADCASTS SPEECHES

More than ten feet high and six feet wide, a gigantic radio receiver stands outside a Cleveland building where it is used to broadcast speeches and luncheon programs to the public. The cabinet is built to scale with one of ordinary size, and the receiving equipment is a magnified duplication of a standard chassis, the only difference being that in the large cabinet are special amplifiers and speakers to furnish the tremendous volume required.

PLAYGROUNDS ABOVE STREETS FOR CONGESTED AREAS

Elevated playgrounds for children over the streets in the congested areas have been proposed by a New York architect. Such playgrounds, it was estimated, could be constructed for about $25,000 each, only a fraction of the cost of acquiring property for them, and at the same time providing the facilities where most needed, instead of in isolated sections difficult for the children to reach. The grounds would be built of reinforced concrete with a steel superstructure and surrounded by a wire net with flower boxes outside the netting to give the effect of a roof garden.

In Foreground Is Shown an Eighteen-Hole Golf Course with Many Unusual Hazards on a Hotel Garage Roof, with a Tennis Court in the Rear; Both Are Floodlighted for Night Playing

PLAYGROUND ON HOTEL ROOF FOR GOLF AND TENNIS

Golf and tennis players enjoy games and practice work by day or night on the roof of the garage of the Hotel Plaza, San Antonio, Tex. The area has been fitted up for an eighteen-hole golf course with interesting hazards, a cage for driving practice and a tennis court. The golf player is afforded excellent tests for his skill at putting and difficult shots, as practically every "fairway," inclosed in a concrete border with traps and water hazards, offers chances for careful shots. Floodlights illuminate the playground at night.

SOLIDIFIED LIQUID IS HARD AND FLEXIBLE AS PAPER

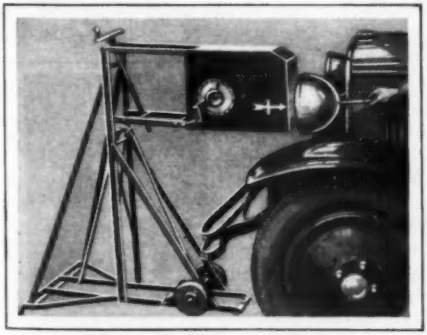
Discovery of a chemical composition combining hardness and flexibility in a remarkable degree, which is expected to be used in a score of industries, has been announced by Dr. Hal T. Beans, of Columbia University. "Durium" is the name of the composition, described as a liquid in its original form which is transformed by heat into an insoluble, infusible solid. A thin film of durium, so hard it can scarcely be broken with a hammer, is almost as flexible as paper. It hardens quickly and therefore can be used in stamping processes at the speed of a printing press. In appearance, it somewhat resembles amber but is highly heat-resistant, making it ideal for molds or matrices. In liquid form, it may be used as a fire-resistant and waterproof spray paint. Its first practical application will be in the making of phonograph records. Durium records are as light as cardboard, flexible and, at the same time, more durable than the ordinary type. Aside from being less fragile, they will also be much cheaper, and are to be released weekly at news stands. The composition also is expected to be used in the large disks for talking motion pictures, for certain types of molding, electric insulation, stereotype matrices and as a varnish where great durability and high luster are important.

SOUNDING BY ECHO IN HUDSON BAY

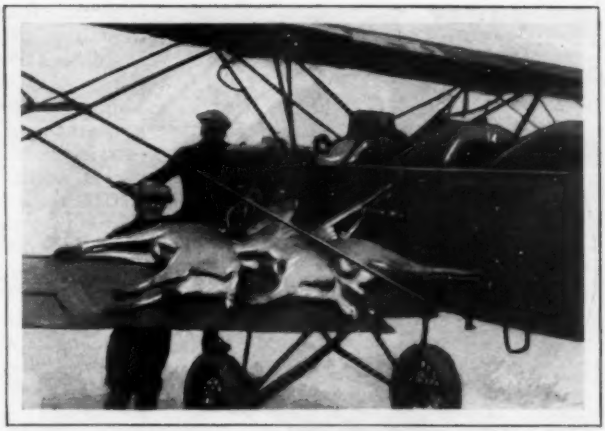
A new type of British admiralty depth-finding equipment was used in Hudson bay for a survey of the floor of the inland sea to make corrections and complete the charting prior to the opening of this waterway to commercial shipping. The instrument on the bridge of the ship shows accurately the depth of the water in fathoms. This is automatically measured within the instrument box, the measurements being based on the time-interval principle of sound travel in water. A note is set up in the hull of the ship by an automatically controlled hammer striking a metal disk and travels to the bottom, setting up an echo which returns to the instrument and enables calculation of the depth. It also warns of approaching shallow water.

PORTABLE HEADLIGHT TESTER ADJUSTS DRIVING LAMPS

Focusing automobile driving lights in any desired position is made easy with a portable headlight tester now available for garages. The tester may be used indoors or outside in broad daylight, and with it a beam may be made to strike the road at any desired distance from the car.



Portable Headlight Tester by Means of Which Auto Driving Lights Are Quickly Focused



Airplane, Used by Deer Hunters in "Spotting" the Game, Landing with the Day's Kill Which Has Been Strapped to the Wings

DEER HUNTED FROM AIRPLANES AND CARRIED ON WINGS

Deer hunting from airplanes is done in certain sections of the southwest where landing spaces abound in the game country. The planes are particularly useful in "spotting" the deer. Flying at high altitude, the hunters are able to detect herds or single animals from a great distance. Care is taken not to fly too low, as that scares the animals and, by the time the hunters have landed, they have disappeared. When the deer are not too large, they may be carried safely on the lower wings of a biplane, strapped securely and the load balanced.

LOG JAM FAR UNDERGROUND

Workmen excavating a tunnel for a Tacoma, Wash., power project in the side of a hill high above the bottom of the canyon of the Skokomish river found a huge jam of logs such as sometimes piles up in a river. The logs, many of them fir, seemed to be as sound as when they were uprooted, although they were discovered 200 feet beneath the ground. The most plausible theory is that the river in remote times piled the logs up, then was forced by the jam to change its course, earth in time covering the logs while the river continued to cut its channel down through the ground until it reached the rock forming its present canyon.

This Huge Rope, Three Feet in Circumference, Is Used to Hold Steamer Anchors

BIG ANCHOR ROPE OF FIBER STRONGER THAN CHAINS

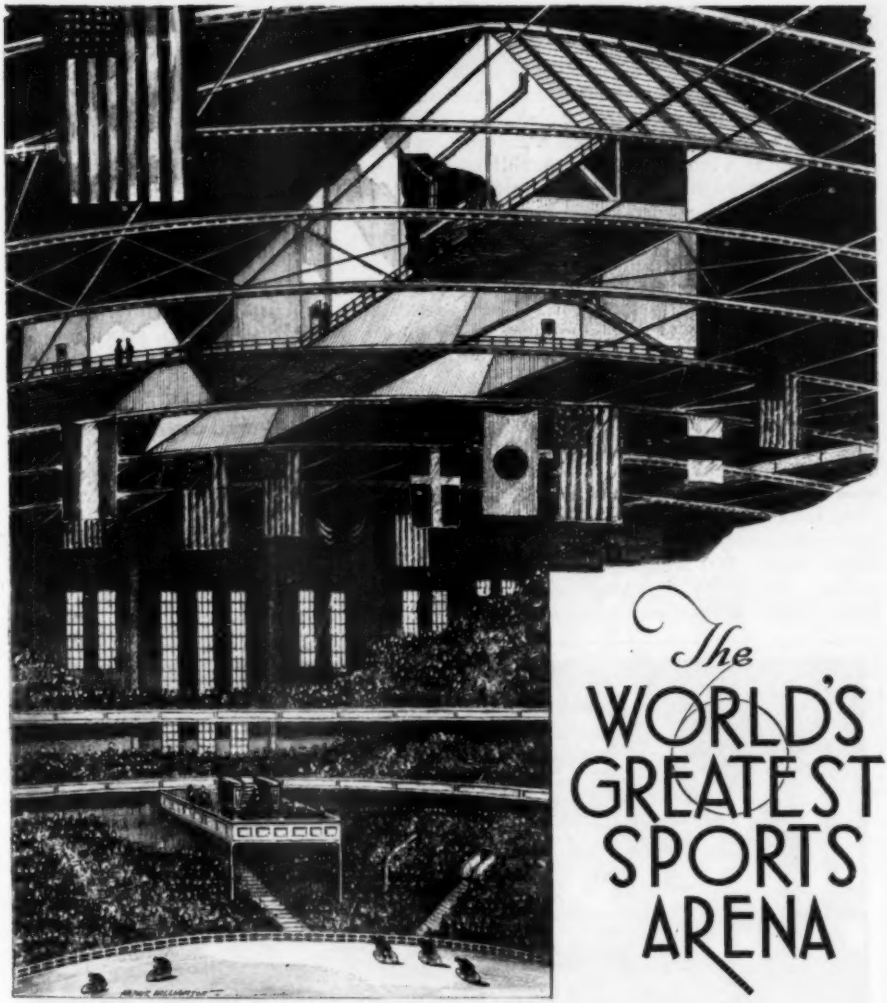
Fibers, woven into a thick rope, stand strains that snap metal chains in holding the anchors of steamers off some of the Pacific islands where there is an unusually strong ocean swell. What is claimed to be the world's largest rope for this purpose was seen in Melbourne, Australia, recently. It is three feet in circumference, 460 feet long and weighs nearly two tons.

SPEED TRAP FOR THE EARTH RACES LIGHT BEAMS

In a sheet-iron shed, that looks like a hot-dog stand closed for the winter, attempts are being made at the Case School of Applied Science, in Cleveland, to catch the earth. Out of it is coming information that threatens the Einstein theory which has attracted so much attention in recent years. In 1887, near the site of the little building, Profs. A. A. Michelson and Edward W. Morley performed experiments to determine whether the earth creates waves or ripples in the ether through which it is supposed to move. Their results were zero, or at least they thought so. They tried to detect the ether drift by measuring the velocity of light in different directions. It is upon the zero they obtained that Dr. Albert Einstein based his theory of relativity. But during the past several years, Dr. Dayton C. Miller has been performing the same experiment with almost the same equipment —trying to find zero—and has failed consistently. In other words, the more than 150,000 readings that he has made all indicate that there is an ether drift, evidenced by difference in the speed of light traveling north and that going east and west. If his findings are accepted, the Einstein theory will be scheduled for remodeling. Scientists have regarded light waves as vibrations in an imaginary substance called ether, that is supposed to be present in all space. The earth and other planets are known to be moving through space at a tremendous speed. Therefore, if there is an ether, it is reasonable to believe that the earth and its neighbors create waves in it, much as a boat sets up waves in a lake, and light, being a vibration in this ether, ought to travel back and forth in the direction of the solar system's motion at a speed slightly different from that across the path of motion. Einstein claims that no one ever will be able to measure this difference in the speed of light—to detect ether drifts. So, if anyone can find positive proof of the presence of ether, the Einstein theory will tumble.

AIR-PRESSURE DOT ON WHEELS SHOWS TIRE INFLATION

Permanently installed through the rim of the new Ford, individual tire gauges for each wheel of the car now are on the market. The pressure indicator is installed in a hole drilled in the rim and is so adjusted that, when a red dot on its top is flush with the rim, a pressure of thirty-five pounds is in the tire. Overinflation is indicated when the dot rises above the rim, and underinflation when it recedes below the rim.



The WORLD'S GREATEST SPORTS ARENA

By PAUL D. PADDOCK

GAMES and circuses are staged under a "big top" of steel in the Chicago stadium, where the latest wonders of mechanical and engineering science have been applied for the better enjoyment and performance of sports.

The structure combines twelve buildings in one. There is room for a football field or a three-ring circus with seats for 18,000 persons. Wrestling or boxing matches can be witnessed by an audience of 25,000, and, a few hours later, ring and mat have disappeared and the floor becomes a skating rink, 150 feet wide and 250 feet long, for hockey games to thrill a crowd of nearly 20,000.

Music roars down from a six-console organ, the pipes and trappings of which are housed in the stadium roof and form the equivalent of twenty-five complete brass bands of 100 instruments each. A 100-horsepower blower furnishes the wind

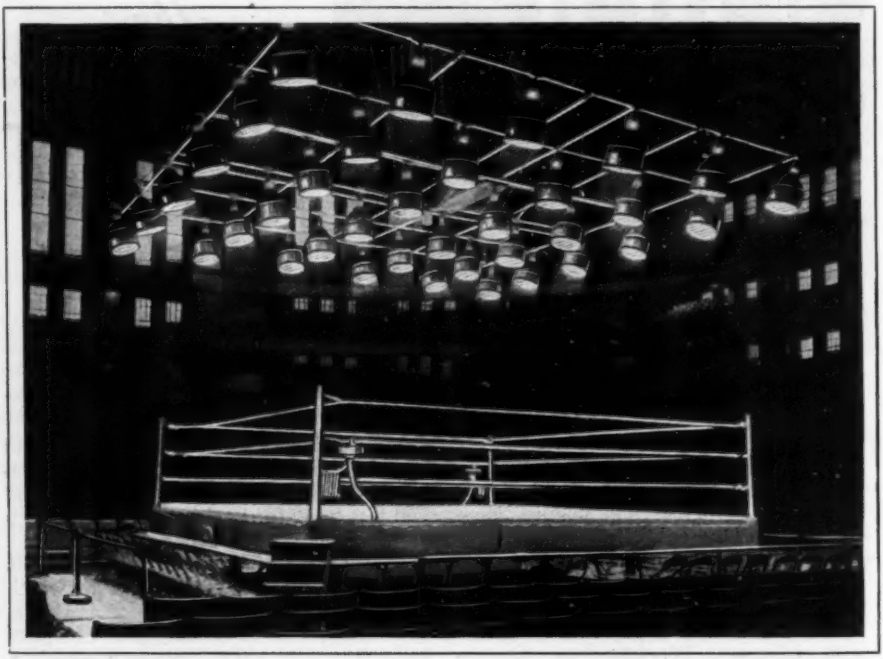
for this mighty assembly and, at the same time, from each corner of the huge arena "manufactured weather" in the form of carefully washed and temperature-regulated air is pumped out to the spectators at the rate of twenty-three tons a minute.

The roof is a story in itself. Architects realized that an unobstructed view from any part of the building would be one of the stadium's chief assets, so they designed a series of twelve semi-arched trusses, each 262 feet long and 114 feet above the arena. The center one weighed 210,000 pounds and the others 180,000 pounds, and all were installed in such a way that no posts or braces cut across the field of vision from any part of the interior.

Besides forming a covering for the stadium, the roof provides the housing for the organ paraphernalia and hoists to raise the lights from over the boxing ring when the matches give way to other forms of entertainment. To make the necessary connections, 5,000 miles of wire were installed. There are five huge organ lofts with "loud-speaker" chambers so arranged that the sound is evenly distributed to all parts of the stadium. The organists can vary the music to suit the performances. For instance, during the sprints at bicycle races, music calculated to inspire the contestants to their best efforts, may be played.

The stadium rests on unexcavated ground, and the main floor proper is of terrazzo. Within this material are hidden the refrigerating pipes for freezing the ice. In a few hours, the skating floor is melted and the area is available for other purposes. The refrigeration plant may be adapted to help cool the air for the building in the summer. For circuses and other events requiring a dirt floor, soil is spread over the terrazzo and then covered with tanbark or sawdust. Flexible mats are laid on the terrazzo before the dirt is applied and then lifted off in units when the rodeo or circus is over.

Special attention was paid to the boxing ring. The powerful lights that shine above the fighters' heads are of a design that creates a minimum of heat. An auto-



Brilliant Lights above the Boxing Ring Are of Special Design to Minimize the Heat; the Entire Lamp Frame Is Hoisted into the Roof When the Bouts Are Over; Note the Fountains at Corners

Boxing Ring in the Chicago Stadium, Showing the Automatic Timing and Recording Apparatus for the Bouts; the Number of the Round Is Flashed on Panel at Left; the Clock Hand Keeps Count of the Minutes in Each Round, and Gong and Siren Are Sounded Automatically; Inset Gives a Close View of the Control Station

matic timing arrangement promotes greater accuracy in handling the matches. The number of each round is displayed in luminous characters at each side of the stadium where all the audience may see. The gong and siren signals are automatically sounded and electric clocks tick off the seconds of each round and indicate the time for each by means of an arrow that travels around a dial, showing just how much time is left in each round. As soon as a round is finished, part of the lights automatically go out and the auditorium lamps are turned on.

In case time out is required, the man who operates the control station presses a button which stops the arrows on the clock dials, but the mechanism inside keeps running so that the round continues from the exact second at which it was halted. Should a boxer be knocked down, the second count is audibly registered to every person in the stadium by means of a loud buzzer which rasps out the seconds at the touch of a button. While this system is even more accurate than the usual stop-watch method of timing the boxers, it does not yet supplant the watches, although many experts have declared that it could be employed altogether and the chances of error and disagreement among the timers greatly reduced.

REVOLVING MAP TESTS SKILL OF AUTO DRIVERS

Applicant for Auto Driver's License Tracing Course He Would Drive on a Street Map

Applicants for automobile drivers' licenses in Vienna, Austria, undergo many difficult tests, including marking on a map the course over which they would drive a car. The candidate grasps a driving wheel controlling a pencil with which he marks his course on a revolving street map of the city fixed on a drum in front of him. If he negotiates the streets on the map without error, he passes this particular test.

ROBOT HAS AN ELECTRIC EYE AND RADIO-TUBE BRAIN

Using an electric eye to keep chemical processes under control, an apparatus that performs many laboratory operations, thereby saving the time of the chemist, was exhibited recently in New York by W. C. MacTavish, professor of chemistry, New York University. Its ability to control operations is due to its sensitivity to slight variations in color and light intensity. The working parts consist of an electric light, a photo-electric cell, which detects differences in the degree of light impinging on it, a radio tube amplifying the signal received from the cell and operating the relays controlling automatic valves. Between the electric light and the cell, for instance, is placed a glass vessel containing an alkali to be neutralized. Above is a tube from which acid drips into the glass. A small amount of chemical indicator added to the alkali maintains a red color until it is neutralized. When the red color disappears, more light passes through the liquid to the cell, causing a signal to the radio tube which operates the relay and closes the valve, to shut off the supply of acid. Professor MacTavish also demonstrated a method of separating two kinds of hydrogen from the ordinary variety of gas and illustrated micro-analysis by accurately weighing a ball of gold which tipped the scales at one-thousandth of a milligram, which is one-twenty-eight-millionth of an ounce. Lithium, a rare, light and strange metal, weighing one-fifteenth as much as iron, and so light it floats even on kerosene and burns if exposed to air, was exhibited at the demonstration before the New York Electrical society.

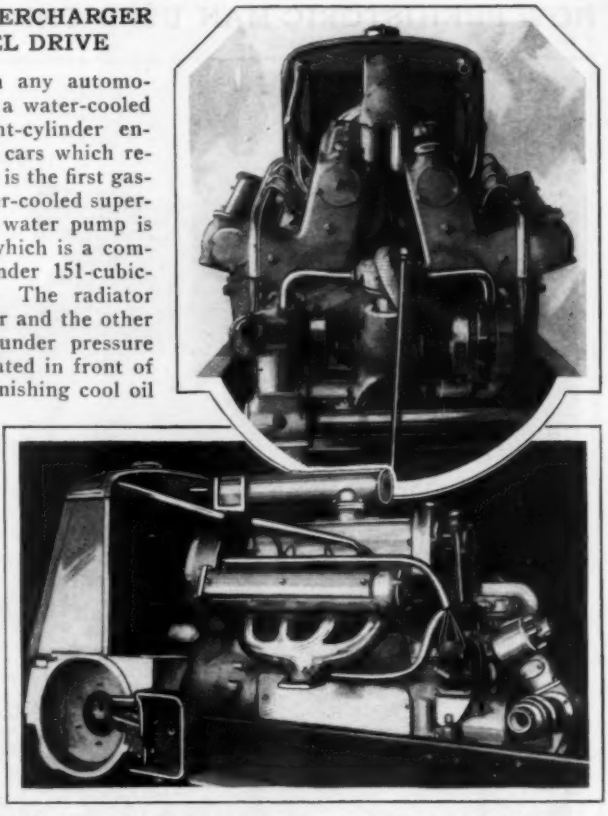
KEYBOARD ON NECK OF GUITAR MAKES PLAYING EASY

Keyboard for Strings to Guitar, Each Key Pressing Give Chord Marked

Eliminating fingering and making chording on a guitar easy, an instrument has been developed with a keyboard on its neck where the fingering is done. The board contains twenty-one keys, each of which, when depressed, presses the strings. Popular music has chord symbols printed above the voice notes, and each chord symbol is duplicated on the keyboard.

WATER-COOLED SUPERCHARGER FOR FRONT-WHEEL DRIVE

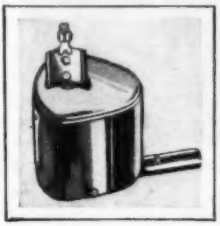
Radically different from any automobile motor yet designed is a water-cooled supercharged V-type eight-cylinder engine for front-wheel-drive cars which recently underwent tests. It is the first gasoline motor to have a water-cooled supercharger. The centrifugal water pump is at the rear of the motor which is a combination of two four-cylinder 151-cubic-inch hydroplane motors. The radiator has two caps, one for water and the other for oil. The oil passes under pressure through vertical tubes located in front of the radiator core, thus furnishing cool oil to the motor and retaining the full lubricating value. In cars of the past, gasoline has been forced, partly compressed through the medium of the supercharge, the fuel being either warm or hot as it reached the combustion chamber as the temperature varied. With the water-cooled supercharger, however, the shot to the combustion chamber is cool, thus salvaging much of the power lost under heated supercharging. Exhaust manifolds and ignition are dual, and the motor is rated at 300 horsepower. It will be eligible for the new type of racing to be inaugurated at Indianapolis on Memorial Day this year.



Side and End Views of Water-Cooled Supercharged V-Type Eight-Cylinder Engine for Front-Wheel-Drive Cars; Note Water Pump at Rear

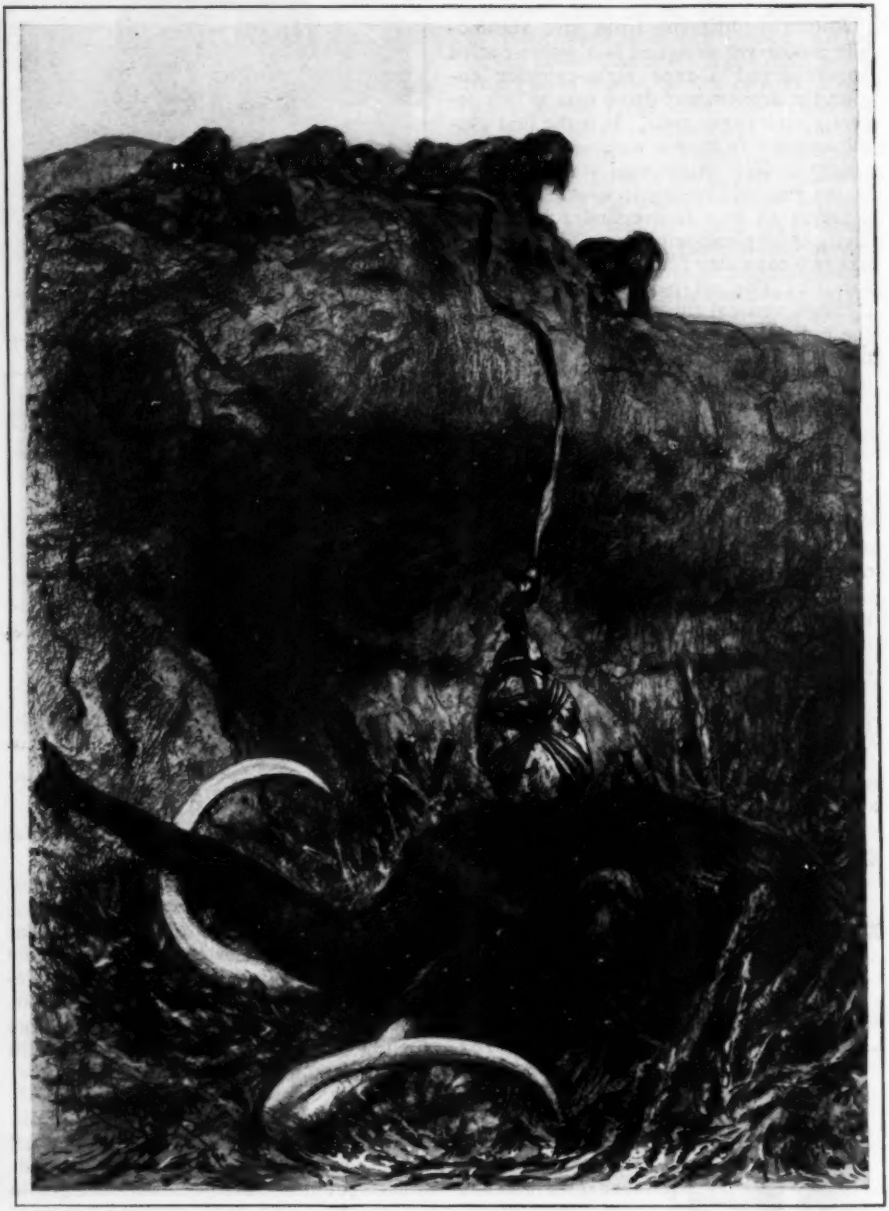
MACHINE GRINDS HOLLOW EDGE ON SAFETY-RAZOR BLADE

Grinding and stropping in one operation requiring only a few seconds, a hollow grinder for safety-razor blades which concaves the edges like those of a hollow-ground straight razor, now is on the market. All faces of the blade are hollow-ground simultaneously when it is inserted in the grinder between rolls made of cellulose containing an abrasive material which needs renewal only once a year. The grinder substitutes the concave edge for the wedge-shaped one, and saves both time and money.



¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished by addressing the bureau.

HOW PREHISTORIC MAN USED THE "KILLER STONE"



© The Illustrated London News

Reproduction of Drawing by A. Forestier from Material Supplied by Dr. Karl Absolon, to Show How Early Hunters Possibly Killed Mammoths after Trapping Them in Pitfalls

TARDINESS OF THE EYE BLAMED FOR AUTO ACCIDENTS

Split seconds required by the eye to register the image of a speeding automobile often represent the direct cause of automobile accidents in the opinion of Dr. T. H. Shastid, of Duluth, Minn. He found that it required one-fifth of a second for even the quickest-sighted person to develop the image of an object in the eye, and some slower-sighted persons take as long as two-fifths of a second. An auto seen traveling at fifty miles an hour, therefore, is, at any given moment, from fifteen to thirty feet in advance of the point where it appears to be, this being the distance covered by the car in the one-fifth or two-fifths of a second taken by the eye to see it. As a result pedestrians often miscalculate the car's distance from them, and the time element also is responsible for statements sometimes made by the victim of an accident that the car appeared to speed up just before he was struck.

Water Scooter, Similar to the Pavement Kind, Which Is Propelled by an Oar Attached to the Foot

SCOOTER PROPELLED IN WATER WITH FOOT-OPERATED OAR

Water scooters, similar to the pavement scooter in operation and in appearance, except that a boat takes the place of wheels, have been added to novel forms of water sport. The scooter consists of a support shaped like a rowboat on which the operator stands. The craft is propelled with an oar attached to the foot.

GARDEN-OF-EDEN TIMEPIECE TWO HUNDRED YEARS OLD

Brought to America from Sweden many years ago, a watch depicting on its face a scene from the Garden of Eden is in the possession of a Seattle man. The timepiece, about 200 years old, shows Adam and Eve, the serpent and the apple and also includes various animals which in years past represented virtues or vices of men. The serpent serves as a second hand, making a path about the scene depicting Adam and Eve with the apple. The remarkable coloring of the garden scene, including reds, blues and other vivid shades, has been faithfully retained.

MAGGOTS FIGHT INFECTION BY EATING DEAD TISSUE

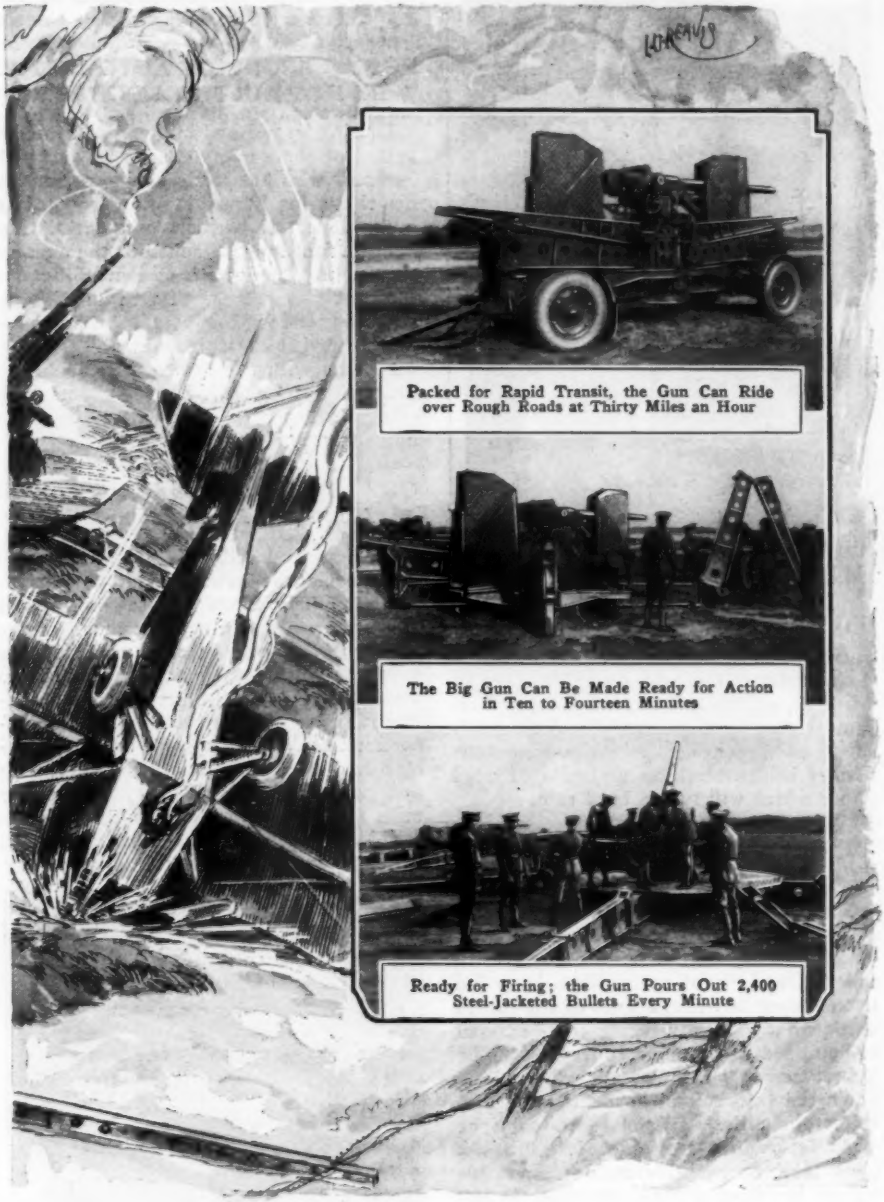
Treating wounds with maggots to prevent infection is being investigated as a result of observations made during the war by Dr. William S. Baer, of Johns Hopkins University. He noticed that when wounded men had been left lying on the field unattended for some time, and were brought in with wounds covered with tiny maggots, they did not develop infections in their injuries, while many of those whose wounds were treated immediately on the field later showed evidences of infection. Further tests disclosed that the maggots were eating the dead tissues, bone and flesh, thus destroying the material that furnishes a breeding ground for bacteria. Doctor Baer has used this treatment to hasten the healing of wounds after operations since the war, with good results.

FAST, MOTORIZED GUNS WITH STEEL BRAINS

COMPUTING APPARATUS CONTROLS AIM AND DISCHARGE OF GUNS
HEIGHT FINDER
STABILIZER
WIRE CONNECTING COMPUTER TO GUN
OUTRIGGERS REDUCE EFFECT OF RECOIL

Artist's Drawing of Special Anti-Aircraft Gun Unit, Showing the Range-Finding Car and Electrical Controls That Aid in Firing; This Is a Three-Inch Gun with Six to Nine-Mile Range

BUILT TO HUNT PLANES IN THE NEXT WAR



Packed for Rapid Transit, the Gun Can Ride over Rough Roads at Thirty Miles an Hour

The Big Gun Can Be Made Ready for Action in Ten to Fourteen Minutes

Ready for Firing; the Gun Pours Out 2,400 Steel-Jacketed Bullets Every Minute

Photographs Showing Steps in the Assembly of the Gun for Firing; This Weapon Was Demonstrated at the Aberdeen Proving Grounds Last Fall before Army Ordnance Experts

Umbrella-Vending Machine in Berlin, and One of the Oiled-Paper Parasols It Dispenses

AUTOMATIC UMBRELLA VENDER SELLS PAPER PROTECTORS

Umbrella-vending machines in Berlin do a thriving business on rainy days or when an unexpected shower catches German shoppers unprepared. An investment of fifteen cents in the automatic vender brings forth an umbrella of oiled paper which will turn a hard rain.

LIGHT ARMOR FOR SOLDIERS RESISTS BULLETS

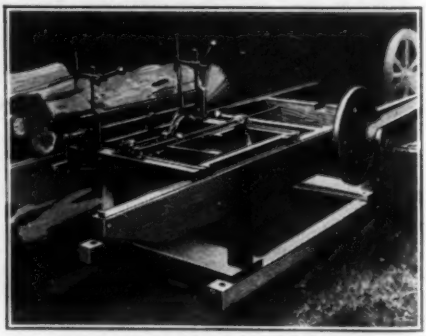
Secret tests of a type of lightweight armor plate of exceptional resisting power, which recently have been made by British military and naval authorities, have led to the possibility that armies of the future may go into battle wearing coats of mail or equipped with bullet-proof shields. The lighter armor plate was made by rolling down the thicker and hardening the surface, thus differing from the usual type of bullet-proof plate which is uniformly hard throughout. Heretofore excessive weight has been a great drawback in the use of armor, whether for tanks, infantry shields or warships. The reduction of the weight of sheet armor by half without diminishing its protective effect would greatly simplify tank construction as well as protection of warships.

FOG IN FRONT OF AUTO LIFTED BY HOT AIR FROM EXHAUST

Driving in a London fog has been divested of some of its danger by a British inventor who has made an instrument to dispel the fog immediately in front of an automobile. It consists of a metal tube about a foot long, attached to the exhaust pipe, which projects a stream of hot air in front of the car with a beam of light, absorbing the fog for several feet and leaving clear visibility for about a car length. Motorists with the device are enabled to proceed through traffic in a fog with safety at a speed of about fifteen miles an hour, tests indicated.

ONE-MAN SAWMILL FOR FARMER ADDS TO LUMBER PROFIT

Making it possible for the farmer to operate his own sawmill without employing other help, a one-man sawmill now is available to turn into profit much of the timber that formerly was used for fire wood or wasted entirely. The mill is so arranged that all the levers to manipulate it are within easy reach of the operator and, aside from sawing out standard-size lumber, will also cut shingles, lath and railroad ties. Stationary or portable mills may be obtained and both are operated by stationary engines, electric motors, water power, or by a belt from a truck.



Sawmill Designed for the Farmer with Levers So Arranged That One Man Can Operate It

STORE ON WHEELS EXPANDS WHEN IT IS PARKED

Traveling the highways as a fast motorized unit, no wider than the ordinary automobile, but expanding, when parked, in both width and height, a traveling store or display room on wheels is now available to merchandising organizations. The vehicle is transformed in ten seconds from an ordinary commercial truck into a commodious display room by manipulating a lever

Interior and Exterior Views of a Traveling Store; When Parked, the Sides May Be Expanded and the Roof Raised to Form a Commodious Interior

which doubles the width by extending the sides, and also increases the height by lifting the roof, which brings glazed windows into view. The body fits on any standard chassis and its interior is decorated with dome and lights and affords sufficient space for display of goods and advertising material, as well as for customers. When closed, the two sides move inward without disturbing the displays on walls or racks. Drawer space also is provided where needed. Aside from being used as a traveling branch store, the unit is also valuable for salesmen visiting retailers. The half-sides of the body are expanded, and the roof is raised simultaneously by a lever in the front compartment which operates an electric motor with automatic control. Each of the half sections, when expanded, will support a ton of weight, making possible the mounting in these sections of machinery in operation for display purposes. The wide rear step is constructed to serve also as a rear bumper. There is sufficient floor space for installation of folding desks or chairs which do not interfere with the closing of the body. Triple locking equipment gives security to the shop and its contents whether open or closed. Expanded, the body is 80 inches high, 103 inches wide and 91 inches long.

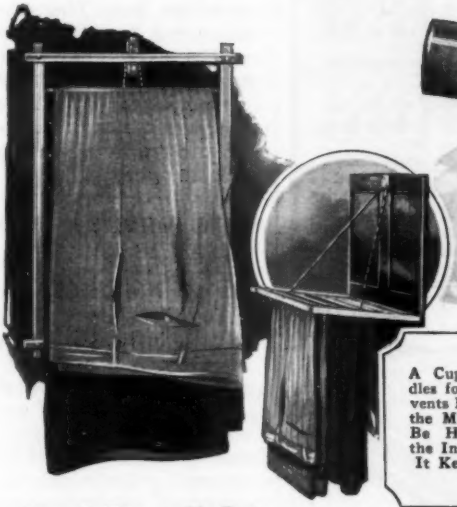
Making Home

To Hold Cleaning Cloths and Polishers, This Adjustable Grip Spares the Hands and May Also Be Used for the Scraping of Pots

Here Is an Efficient Electric Range That Is Built Up or Taken Down in Units like a Sectional Bookcase for Kitchens of Different Size and for a Wide Variety of Cooking Tasks

When Folded Up, This Breakfast Set Serves as a China Closet, Yet Seats Four or Five Persons When Extended; It Can Be Built into the Wall to Save Further Space and Is Easily Adjusted

Tasks a Pleasure



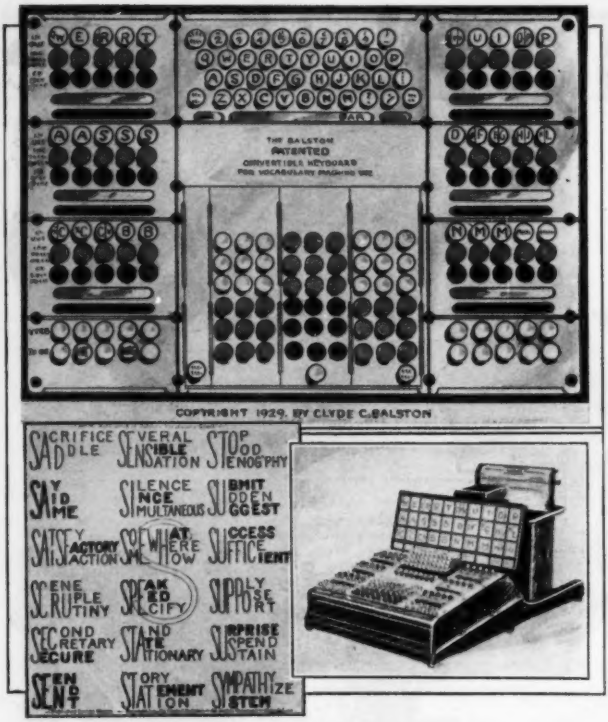
Trousers' Hanger with Drop Rack Fits in Small Space and Simplifies the Task of Putting the Garments Away; It Can Be Used on a Closet Door

A Cup Holder with Handles for Baby's Bottle Prevents Breakage, Helps Keep the Milk Warm as It May Be Heated, and Protects the Infant from Disease, as It Keeps the Bottle Clean

Vegetable and Fruit Shredders of Different Degrees of Fineness Have Wide Usage and Save Time in Preparing Many Foods

Electric Hair Drier That May Be Attached to the Wall Is Serviceable for the Bathroom, the Gymnasium Locker Room or the Swimming Pool

The Back of This Strong Kitchen Spoon Is Corrugated for Grating Foods, and Prong at End Aids in Handling Croquettes, Sticky Potatoes and Similar Foods



Rapid Typing Machine That Prints Whole Words and Phrases at a Time, View of Keyboard, and Some of Word Combinations

RAPID TYPING MACHINE PRINTS WHOLE PHRASES AT A TIME

Whole words and phrases are instantaneously spelled and written by the depression of only two keys on a rapid-typing unit an eastern inventor has developed. It is essentially a typewriter in function, but greatly speeds the operator's performance, 300 words per minute being easily printed when writing single words only, and many more when whole phrases can be employed. The principle of the machine is based on the fact that about 100 common words constitute more than fifty per cent of the contents of the usual business letter. The great bulk of ordinary conversation and daily speech is confined to about 400 different words. Recognizing these facts, the inventor arranged the machine in such a way that depression of two keys would print the entire word. Such phrases as "My Dear Sir," "by return mail" and others commonly written are likewise reproduced almost instantly, often but five or six key operations being sufficient to write a whole line. The machine can be adapted to special tasks, such as billing telephone tolls and similar work. With little practice, it is said, a novice can learn to use the machine very rapidly.

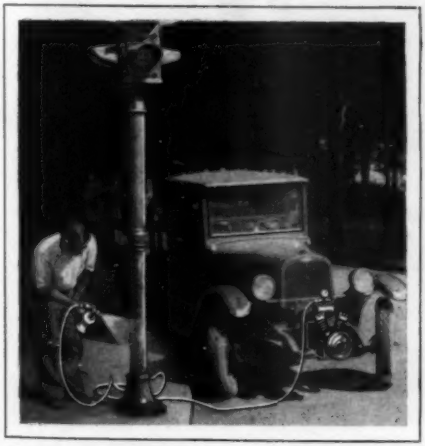
REMOVING TATTOO MARKS IS TASK FOR DOCTORS

Tattooing, according to Dr. Melvin D. Shie, of Cleveland, who has specialized in the removal of skin designs, is of ancient origin. The Egyptians practiced the art of decorating their skin, as indicated by tattooed mummies. But the art is by no means associated only with primitive peoples. It is practiced more widely today than ever before, Doctor Shie claims. Although the electric needle and modern methods have done much to remove most of the risk attending the decorating of the epidermis, there still is considerable danger when the tattoo artist does not use surgical precautions to prevent infection. Tattooing, in general, consists in imbedding pigment in the skin. If the coloring matter is deeply applied, the tattoo is quite permanent. Otherwise it may fade or be removed by some process such as accidental burning or action of light. The pigments are applied by puncturing the skin and forcing them into the wound. Since tattooing is merely an imbedding of pigment in the skin, its removal consists mainly in extracting the coloring matter, but to do this without excessive scarring or discomfort is not always easy. Tattooing designs can be removed by chemical, electrical or surgical means, but the removal is often more painful than the original ap-

plication, and it usually leaves some kind of scar. Small, outlined figures, such as daggers, are easily removed by surgical means, leaving only a fine, hairline scar. But when someone approaches the doctor with a request to erase a four-masted schooner or a well-equipped battleship, the problem is a little more complicated. Although there are several methods by which tattooed designs can be taken away, one of the most satisfactory involves treatment of the tattooed area with tannic acid. The acid is imbedded in the skin thoroughly by means of an electric needle, dental engine or a group of needles fastened in a cork. Then the tattooed skin is rubbed with silver nitrate which, reacting with the tannic acid, produces silver tannate. After several days the scab that forms over the area is removed, taking with it the pigment.

PORTABLE COMPRESSOR ON CAR OPERATED BY ENGINE

Driven by the automobile or truck engine, a portable compressor which may be attached to the front of a car now is on the market. It is operated by hand-lever control and is driven from the motor crankshaft. Garage road-service trucks find it useful in obtaining air for tires, and it may also be used for paint spraying and operating pneumatic tools. It can be mounted on any make of car or truck.



Portable Compressor Attached to Auto, Which May Be Used for Paint Spraying or Tire Inflation

Four One-Ton Ground Rollers Like the One Shown Are Used to Anchor This Big Dirigible

ANCHORS FOR GIANT DIRIGIBLE ARE ONE-TON ROLLERS

Four one-ton ground rollers serve as anchors to hold the giant British dirigible "R-101" in place when the ship is moored to its mast at Cardington. The rollers are suspended from the tail end of the ship, to keep it from swaying and hold it at a constant level.

BLUE GEM COLORED BY HEATING

Jewelry experts, puzzled by the appearance of a sparkling deep-blue zircon, have decided that the comparatively new element, hafnium, is responsible for the color. It was learned that crystals of blue zircon all originated from a certain locality in Siam where the brown mineral, before being cut, was heated for some hours in a closed crucible with cyanide of potassium, emerging in colors ranging from nearly white to deep sapphire-blue. Only the heavier varieties of the mineral turn blue, and these are the ones containing hafnium, which is believed responsible for the color manifestation.

Big Shovels

AN able-bodied laborer, armed with a hand shovel, digs a cubic yard of loose dirt an hour. Working eight hours a day, it would take him two whole days to dig enough to fill the dipper, alias the bucket, of an electric shovel constructed a few months ago.

In dipper capacity, though not in some of its other dimensions, the shovel in question is the world's biggest up to date. Its total weight is 1,036 tons. The dipper alone weighs twenty-six tons. Filled evenly to the brim it holds sixteen cubic yards. In actual digging, the material is usually heaped above the brim, so that it handles seventeen to eighteen cubic yards at each filling. The steel cables that hoist it through the dirt are as thick as a man's arm.

The famous steam shovels that dug the Panama canal were puny in comparison with this electric giant, yet it was designed for no romantic feats of engineering. Shipped unassembled on twenty-eight railroad flat cars to southeastern Kansas, it was erected on the open prairie and put to work scooping up a layer of soil, about twenty-five feet deep, overlying a three-foot seam of coal. The process is called "stripping."

Several other shovels of spectacular size have been built within the past three years for similar work. They have made possible a striking increase in the open-pit mining of coal; an operation still unfamiliar to most Americans, though it was the earliest method of mining coal in this country. Originally the surface earth and rock was removed by pick and shovel, loaded into wheelbarrows, and dumped. Some of the early wheelbarrow runs

Courtesy Link-Belt Co.

Gas-Powered Shovel Loading Bowlders Too Big for the Scoops at a Texas Quarry

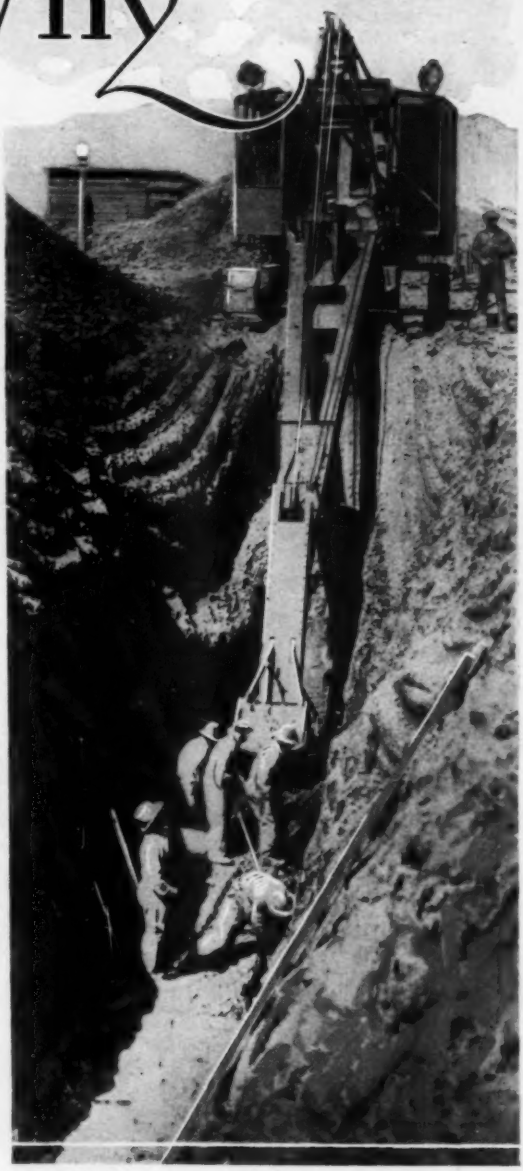
and Why

and dumps can still be seen in the anthracite district of Pennsylvania. Later, somewhat deeper coverings were removed by means of horse-drawn scrapers, but the seams of coal near enough to the surface to be reached by these primitive methods were worked out years ago, and this kind of mining ceased to be of any importance.

With the advent of big power shovels, a revival of coal stripping began. Lately it has made such progress in some parts of the country that near-by underground mines find it difficult to compete with the cheaply operated surface mines. As recently as the year 1914, only three-tenths of one per cent of all the coal mined in the United States was obtained by stripping, but the amount has since risen to more than three per cent and is steadily increasing. A total of 19,000,000 tons of coal is now mined by this process in an average year.

A single open-pit mine in Indiana is producing 4,500 tons of coal a day. The methods followed at this time afford an interesting contrast to those traditionally associated with the mining of coal. Though no shafts need be sunk or tunnels driven, as in underground mining, the task of reaching the coal is by no means an easy one. The seam lies from ten to sixty feet below the surface and is overlaid by a thick layer of solid rock, mainly limestone.

Before this cover can be removed by the shovels, it must be blasted. At this 5,000-acre mine, as at several other large-scale strippings for coal and ore



Courtesy Link-Belt Co.

A Huge Shovel Turns Trench Digger and Tears Out a Ditch Eighteen Feet Deep, a Cubic Yard at a Time

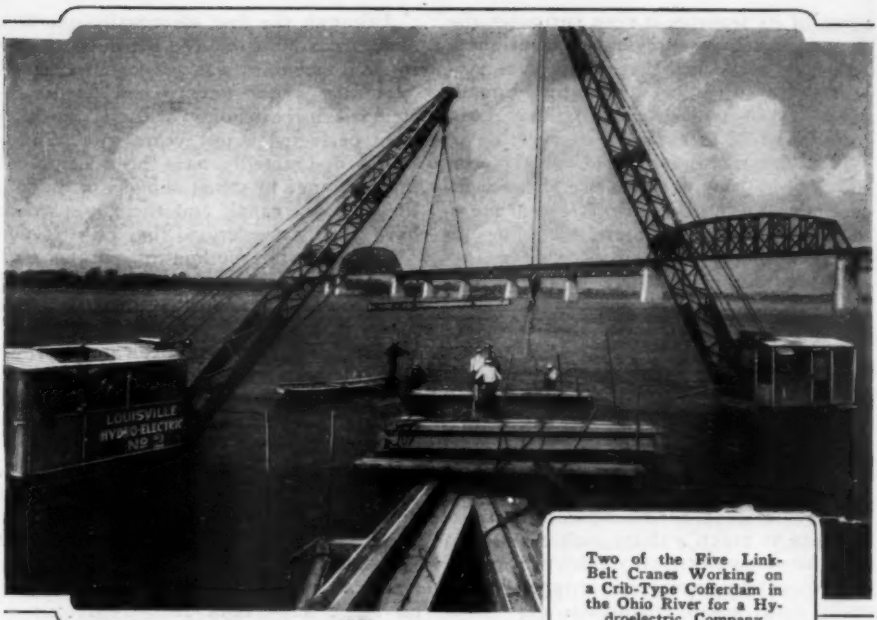
in this country and abroad, black powder and dynamite have been replaced, for blasting, by the equally powerful and much less expensive liquid-oxygen explosive, known to miners as "LOX." The liquid oxygen is produced at the mine. The cartridges consist of bags of powdered carbon soaked in this temporary liquid and are prepared shortly before blasting, as the effective life of a cartridge is only about forty-five minutes. They are lowered into drill holes and fired with an electric battery.

Half a dozen big shovels perform the stripping at this mine, the biggest being an electric shovel that takes twelve cubic yards at a bite. Smaller shovels dig out the coal after it is uncovered and load it into mine cars, which carry it to a tipple, where it is screened and prepared for market.

Another huge coal stripping, located near Du Quoin, Ill., is equipped entirely with electric shovels and drag lines. The largest shovel used here has a dipper with a capacity of fifteen cubic yards, while in

Courtesy Bucyrus-Erie Co.

In Circle, Colossal Bucket of Huge Shovel Built for Stripping Coal in Kansas; It Bites Sixteen Cubic Yards at a Mouthful; Below, Traction Trucks and Hydraulic Jacks of the Monster Shovel



Two of the Five Link-Belt Cranes Working on a Crib-Type Cofferdam in the Ohio River for a Hydroelectric Company

Power Shovels and Cranes Have Moved Mountains and Dug Canyons, Changing Topography in a Fraction of the Time Smaller Tools Would Have Required

some of its features it even surpasses the Kansas machine, previously mentioned. So great is its reach that it can place material eighty-five feet above the ground, or on top of a seven-story building. Its total weight is 1,600 tons.

It is estimated that upward of 550 power shovels of all kinds are in use at open-pit coal mines in the United States, and more than ten per cent of these, including all of exceptionally large size, are driven by electric motors. The huge electric shovel is the most economical of all digging machines, and with this tool at his disposal, the miner finds it profitable to go deeper for thin seams of coal than was ever practicable with the use of steam shovels. The rule of thumb at strippings where this type of machinery is employed is that it pays to remove a foot of surface material for each inch of coal in the underlying seam—to remove, for example, thirty feet of waste to reach a thirty-inch coal seam —but at some electrically equipped mines the proportion of material stripped is actually much greater than this.

Although the first electrically operated shovel was built in 1899, the development of such machines was so slow that up to 1914 only about twenty had been constructed in the whole world. If they had been perfected a few years sooner, they would undoubtedly have been employed in preference to steam shovels in digging the Panama canal, and their use would have greatly accelerated that historic job.

The open-pit method of mining iron ore is more familiar than the stripping of coal because the most productive iron mines in the world, located in the Lake Superior region, have been worked by this method for many years. Steam shovels were first employed at some of them in 1893 and electric shovels were introduced in 1920. While much iron is mined underground in the same region, there are nearly eighty open-pit iron mines. The Hull Rust mine, on the Mesabi range in Minnesota, is a far bigger man-made hole in t[illegible]ian the Culebra cut in Panama, and from this pit alone more than 100,000,000 tons of

Another View of the Sixteen-Cubic-Yard Dipper; It Would Take a Laborer with a Hand Shovel Two Eight-Hour Days to Dig This Quantity of Dirt

iron ore has been dug up to date—about two-thirds the average annual supply of the entire world.

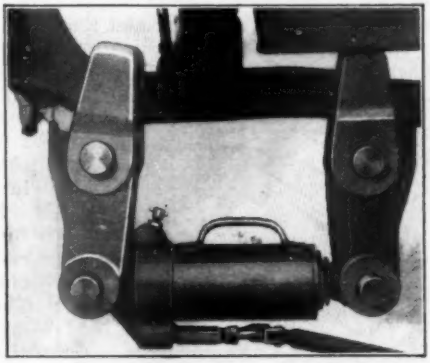
All the larger pits are terraced down the sides and standard-gauge railroad tracks are laid on the ledges for the trains that spiral down into the pit and return to the surface laden with ore or waste. A few of the mines are now completely electrified, using electric locomotives to haul the cars as well as electric shovels for stripping and mining.

A COOLER FOR ROOFS

Providing a constant inlet of air to supplement drafts, through openings cut in the ordinary sheet lengths, a system of air circulation for iron roofs has been devised to keep them as cool as those of tile. Entrance of rain is prevented by metal covers over the openings and insects are kept out by metal gauze. The inlets, about nine inches in diameter by twenty inches in length, are located near the lower part of the roof, above the ceilings of rooms, and operate with a ventilating cowl near the ridge. An opening in the ceiling of the room allows heated air to rise into the roof and be carried out.

AXLES BENT BACK INTO SHAPE BY STRENGTH OF HAND

Reducing or increasing the camber of the front wheels of an automobile is easily accomplished in a few minutes with a hydraulic axle setter now available for garages. It takes the strength of only one hand to cold-bend a car axle up or down while it is attached to or detached from the car. The setter is light and portable and may be used to bend either end at will, or to alter both ends simultaneously, requiring from eight to fifteen minutes for the average operation.



Hydraulic Axle Setter Requiring Strength of Only One Hand to Bend Auto Axle Cold

Consulting Guide Attached to Lamp-Post; Steel Leaves in the Directory Withstand Weather Conditions

CITY GUIDES ON LAMP-POSTS HAVE STEEL LEAVES

Street directories are easily available to travelers in Oakland, Calif., in the form of books with steel leaves attached to lamp-posts at the intersections. Maps and directions for reaching points of interest are contained in the guides, which are six inches wide and sixteen inches long.

BURN COAL IN GROUND FOR GAS

Patents have been sought to cover a process of burning coal underground and piping the resulting gas to the surface. By controlling the burning fuel, either petroleum or carbon dioxide may be produced, the former being refined into gasoline and the latter being used for dry ice, both at low cost. The gas can be piped to the consuming area or burned at the mine to generate electric power.

A Practical Power

By J·S·Hagans

THE DESIRE of an experimenter to try out different a.c. circuits and power amplifiers requiring high plate voltages is frequently blocked by the lack of a power transformer with secondary windings to suit a wide variety of circuits. The transformer to be described has been designed to meet these requirements within the widest possible range at a comparatively low cost.

The diagram, Fig. 1, shows the various windings and their positions on the core. It will be noted that this transformer supplies 1½, 2½, and 7½ volts, the 7½ volts to supply either one or two of the type-210 power amplifier tubes. There is also a 7½-volt winding for either one or two of the half-wave rectifier 281-tubes, and this is provided with a center tap. The output windings for the rectifier plates are wound for 550 volts each. If only half-wave rectification is desired, only one of the high-voltage windings is used with one of the 81-tubes. For smooth full-wave rectification it will, of course, be necessary to use both high-voltage windings and two of the type-81 half-wave rectifier tubes. If two of the 210 or 250 power amplifier tubes are used in push-pull, it will be necessary to use full-wave rectification.

The first step in construction is to prepare the laminations for the core. These may be cut by hand from silicon-steel blanks or purchased, ready-punched to the specified dimensions. The ready-punched laminations will only cost about $2, so little will be gained in cutting out your own unless you happen to have the blank core material on hand. About 150 of these E-laminations are required to build up the core to the necessary thickness and the same number of the end or I-laminations. The laminations should be coated on one side with lacquer to insulate them from each other for cool transformer operation, although this is not absolutely necessary.

Next make a spool or form on which the primary and several secondaries are to be wound. The simplest way of doing this is to wrap a piece of 1/32-in. fiber around the center leg of the full stack of E-laminations.

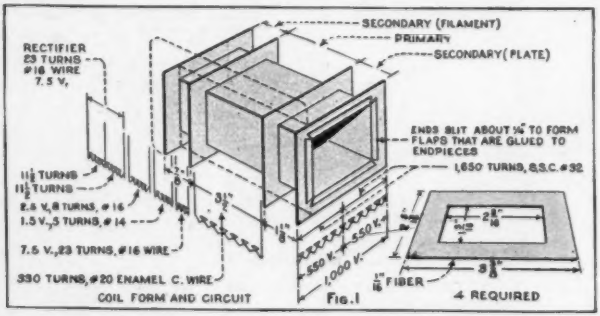
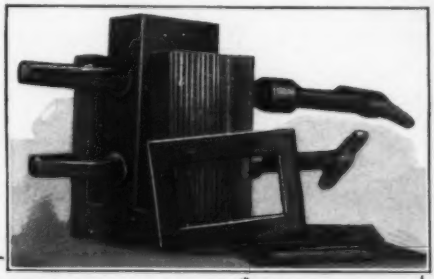


Fig. 1

Homemade Transformer

Make this strip of fiber about 1 in. longer than the core leg, then wrap the strip around the center leg of the core to find exactly where the spool is to be folded in order to fit accurately. Lap the edges over each other, apply glue and clamp until dry. (See photo and diagram Fig. 2.) When the glue is thoroughly dry slip the spool off the core and slit the ends which are turned back, to make flaps to be glued to the endpieces of the form. Four of these pieces, as detailed in Fig. 1, are required, and they must be placed on the spool before the endpieces are glued in place. These spacers divide the various windings, and their proper spacing is shown in the same illustration.

Inasmuch as the windings are to be put into their spaces individually, it is a good idea to hold the spacers in place with blocks of wood bound together with tape. This will keep the spacers from being pushed out of place while the individual windings are being wound. The spool, when completed, should make a close fit inside the stack of E-laminations so that the I-pieces, when the core is assembled, will butt against the E-laminations. It will be well to remember, before the winding is started, that none of these coils, including the friction-tape insulation, should extend beyond the outside edge of the spacers. This is highly important, because, if the windings are allowed to bulge over, especially on the long side of the spacers, difficulty will be met with later in getting the completed winding on the iron core.



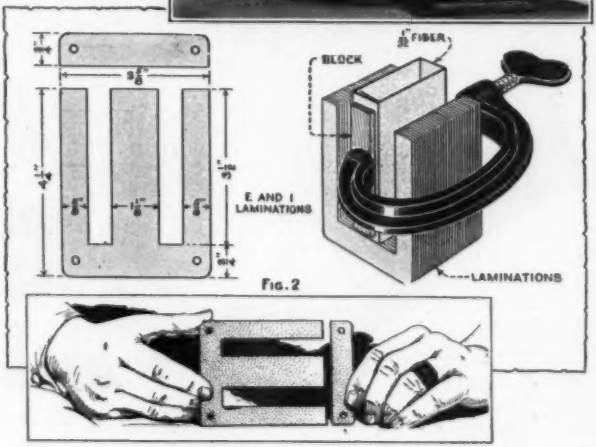


Fig. 2

The winding may be started at any point, but the hardest part of the job will be the several thousand turns of No. 32 s.s.c. wire, and hence it is best to get this winding out of the way first. A simple coil winder with a turn counter is necessary for this operation, as the layers of wire must be put on smoothly and the number of turns accurately counted. Two ¼-lb. spools of this wire will be sufficient for these windings. If only one of the high-voltage windings is to be used, as in the case of half-wave rectification, one spool will be sufficient. If the two windings shown in the diagram are employed, the center tap will come off somewhere about the end of the first spool, so that cutting the wire and soldering on the end of the new spool will make a convenient way of taking off the tap.

Before starting the winding of this fine wire, it will be necessary to solder on a short piece of insulated flexible wire which will later serve as a lead to the terminal on the panel. These flexible leads must be carefully soldered and all exposed joints insulated with friction tape. Each of the plate windings consists of 1,650 turns of wire With the average coil winder, the builder will find it necessary to cut a wooden form to slip inside the coil form, and it may also be necessary to drill a hole through the wooden form so that it can be slid on the winder shaft. This will depend on the type of winder used.

After the 550-volt windings have been completed, you are ready to wind on the primary, consisting of 330 turns of No. 20 enamel-coated wire for a 110-volt 60-cycle source. If your line voltage happens to be 120 volts, add 30 turns. When this winding is in position, wind on a layer or two of friction tape. This also applies to all the other windings. Take care, in handling the enamel-coated wire, not to injure the insulating coating, which may cause a short circuit between turns.

Finally the several filament-heater secondaries are wound in the remaining space on the coil form. The rectifier-filament center-tap is taken off at 11½ turns. The wire used for the amplifier, rectifier and other filament-heater secondaries is s.c.c., and the sizes are given on the wiring diagram.

For convenience as well as accuracy, except in the plate windings where a counter is a necessity, start and finish all windings on the narrow side of the spool. This brings all terminals out on the same side of the completed coil as shown in Fig. 3.

When the windings are completed, they should all be tested with a voltmeter and battery, or battery and headphones. Test each winding individually and against all the other windings and the core, for continuity and possible shorts. If a short is found, it will most likely be

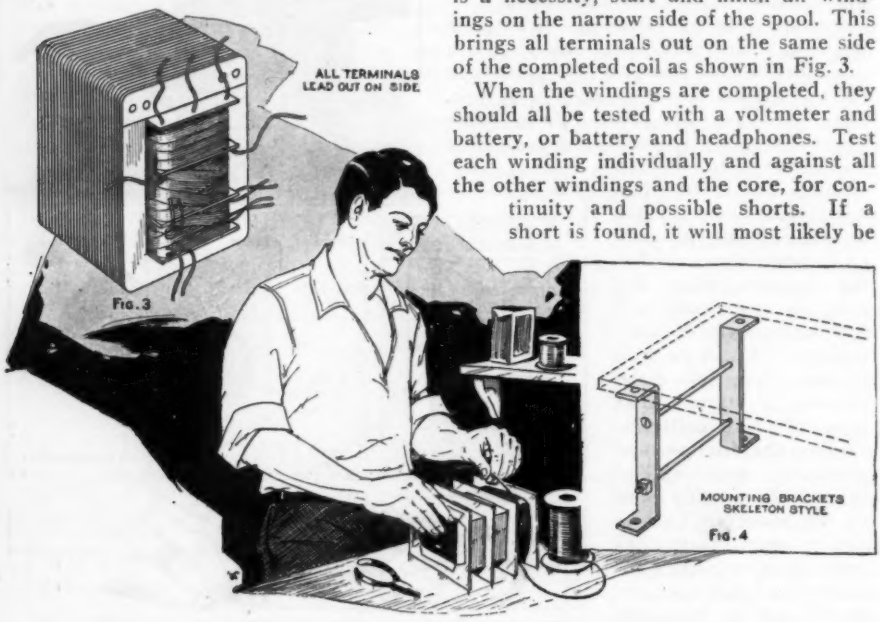


Fig. 3

Fig. 4

in the filament windings where s.c.c. wire is used for economy and saving of space. The only remedy for a short is to take off the winding until the short turn is found.

The assembly of the core is next in order. If the coils have been wound within the limits of the spacers, no trouble will be encountered when the E and I-laminations are inserted alternately so as to break the opposite joints. Manufactured laminations are punched with holes so that bolts may be used to hold the laminations together. The core should form a practically solid block of metal whether bolts are used or not; if it does not, insert wedges and see that the coils fit tightly.

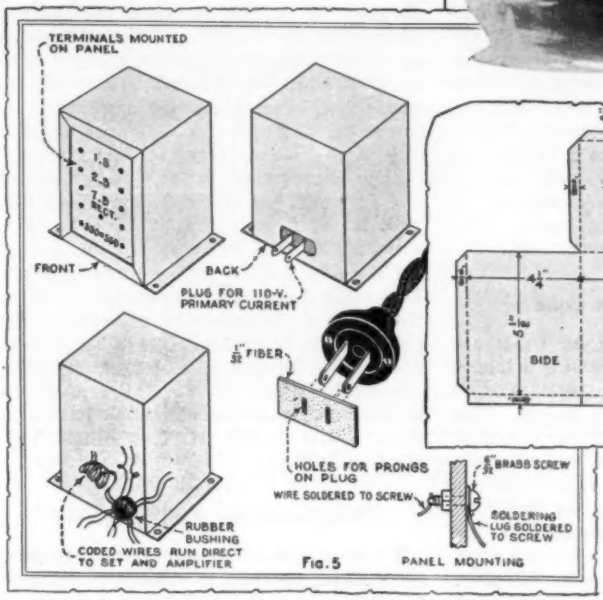


Fig. 5

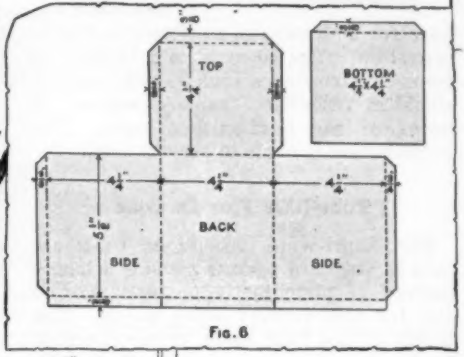


Fig. 6

The completed transformer may be mounted on brackets in skeleton style without a can, as indicated in Fig. 4.

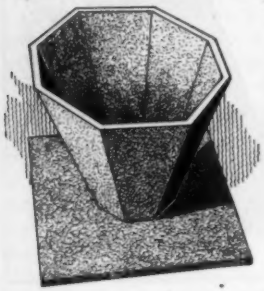
Be sure that all leads are carefully identified before the transformer is placed in the sheet-tin container, for, after the sealing compound is poured in, it will be too late to rectify mistakes. The plug arrangement is inserted through the fiber strip from the inside and connected to the primary-coil terminals for the external plug from the 110-volt supply, or lampcord may be soldered directly to the primary terminals and taken out through a rubber grommet in the side of the can. The terminals may be arranged on a panel or cabled together, as shown in Fig. 5.

The can details are very simple and are clearly shown in Figs. 5 and 6. Insulating compound or melted rosin may be used to seal the can. The transformer is stood on its head as the sealing compound is poured in, and it will be necessary to place a small wood block between the top of the can and the core to keep the two apart during the sealing process. Then the bottom is soldered on, and the separate windings are again tested before connecting the transformer to the 110-volt line.

¶Loud clicks and rasping noises heard at certain points when the tuning dial is varied, usually indicate touching condenser plates.

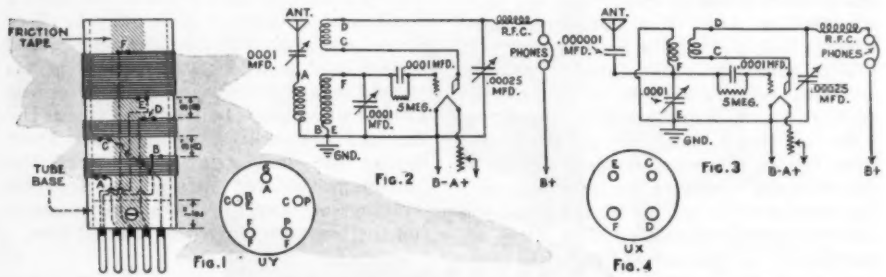
Horn Made from Cane Fibers

A non-resonant material made from sugar-cane fibers is used by broadcasting stations and sound-picture studios for the purpose of eliminating sound reflection, and the same material is now employed in the construction of a combination baffle and horn for auditoriums, as shown in the illustration. The horn is said to be free from characteristics such as echoing and chamber resonance, usually present in horns of the hard-surface types. The combination is made in several sizes.



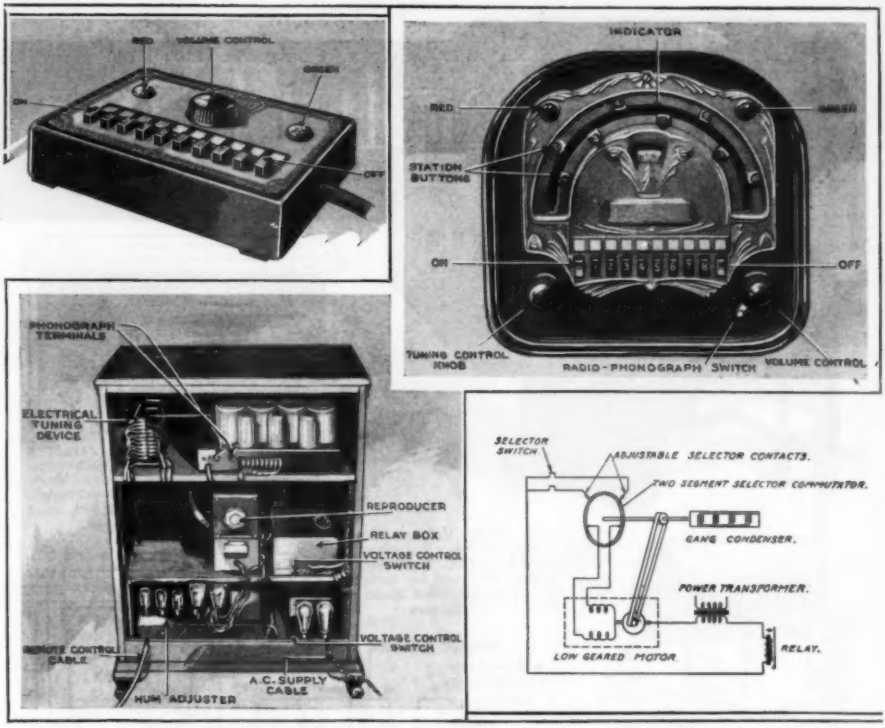
Tube-Base Plug-In Coils

For short-wave reception, tube-base coils in standard sockets provide a handy method of plugging inductances in and out for the various wave bands. The length of the tube bases, either the four or five-prong type, naturally limits the number of turns that may be used, and for 50 to 100 meters especially, in order to get the proper number of turns, small wire and unspaced turns have previously been necessary when making coils in this way. While the resistance of the finer wire may be negligible, the lack of spacing between the turns is a disadvantage. The available winding space on the tube base may be increased any desired amount for spaced winding by the use of tubing of the same inside diameter as the outside of the base, which is 1⅜ in. The tubing may be fastened to the tube base by three No. 6-32 machine screws. (See Fig. 1.) To prevent the wire from slipping as the coils are wound, apply two or three narrow strips of friction tape lengthwise on the tube. The number of turns will be determined by the size of the condenser to be used and the wave band to be covered. This is best determined by trial, but handy data on the subject may be obtained by referring to the article on page 1013 of the December, 1929, issue. If the antenna is coupled to the receiver by a small condenser, as in Fig. 3, the standard UX 4-prong base, Fig. 4, may be employed. If an antenna-coupling coil is used, as in Fig. 2, the UY 5-prong base is required. The grounded end of the antenna coil and the filament end of the grid coil, in this case B and E, as shown in Figs. 1 and 2, are both connected to one of the prongs on the UY socket. All connections are best made by passing the wires down on the inside of the tube where they are then soldered to the base prongs. The antenna coil should be wound near the tube base, the tickler above this and the grid coil at the top, as indicated by the letters in Figs. 1 and 2.—W. H. Cummings, Valparaiso, Ind.



Demonstrating A.C. Receivers

To demonstrate several a.c. receivers, connect all the sets to the same antenna but use no ground. This has been done successfully with four receivers on the same antenna. It will be handier than throwing switches or changing connections when comparing several sets.—G. Curtis Engle, Ridgewood, N. J.



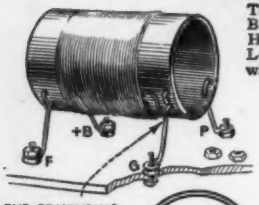
Upper Left, Remote-Control Unit Showing the Various Controls; Right, Local-Control Panel; Lower Left, Complete Installation in a Modern Receiver; Right, Diagram of the Automatic-Tuning Method

Remote Controls for Set Operation

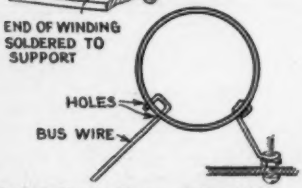
A number of remote-control devices for use with standard receivers, enabling the owner to operate the receiver from any room in the home, have made their appearance during the past few months. By means of these ingenious arrangements, the receiver is automatically turned on, stations are selected and volume regulated to suit the individual. A control unit, scarcely larger than a man's hand, contains all the equipment for actual remote control, in the device illustrated. Switching on the set is done by pressing a small button on the box, marked "Start." When the tubes are lighted and the set is ready for reception, a small red light glows on the control box and another at the set. A station is then selected merely by pressing any of the eight buttons in the control box, the buttons being marked to correspond to the call letters of the stations to which the receiver is set. The operation of the receiver is not limited to the remote-control point, since all controls on the set may be used in the ordinary manner. When the button on the control unit is pressed, a green light glows; the button is kept pressed down until this light goes out, indicating that the receiver has "tuned itself" to the station desired. The automatic tuning is accomplished by means of a small motor in the set, which rotates the variable condensers to the proper point. A "Stop" button on the control box automatically disconnects the power from the receiver, and the red lamps then go out. The selection of the stations that are to be controlled from a distance is merely a matter of setting a few "station buttons" on the control dial on the receiver. These buttons may be set for any station; they operate brush contacts on an insulating segment located on a moving drum.

Helpful Hints

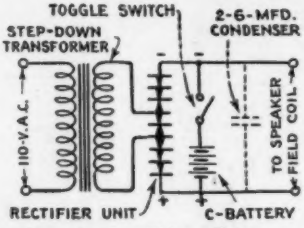
Shock-Proofing Tubes in Experimental Hookups; the Same Idea May Be Applied to Portable Receivers or Installations in Automobiles



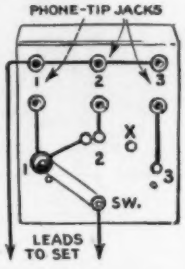
To Check Plate Voltages from Resistor Bank, Ground the Negative Side of a High-Resistance D.C. Voltmeter to Chassis; Left, Busbar Supports for Inductance Coils, with Circuit Connections Made at Subpanel Screws



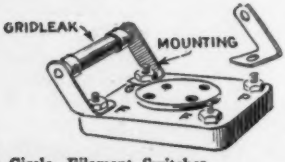
Below, a Handy Means of Providing a Gridleak Mounting When the Leak Is Connected Directly between the Grid and Filament; This Method Is Now Used in Many Receivers, and Especially in Short-Wave Sets



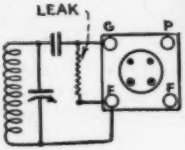
Above, for Low-Voltage Dynamic-Speaker Hum Elimination, Use Small Dry Battery of Same Voltage as Rectifier; if over 10 Volts, Use Condenser Instead of Battery



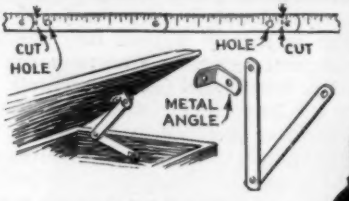
A Triple Speaker Switch; Contact No. 1 Is for Single Speaker, No. 2 for Two Speakers, and No. 3 for Remote Speaker; X is a Blank Contact



In Circle, Filament Switches of the Push-Pull Type, Still Used in Many Battery Receivers, Have Two Flat Springs, Which Drop into a Groove on a Metal Disk When the Circuit Is Closed; When These Springs Weaken and Make Poor Contact, a Rubber Band around Them Will Restore Good Contact

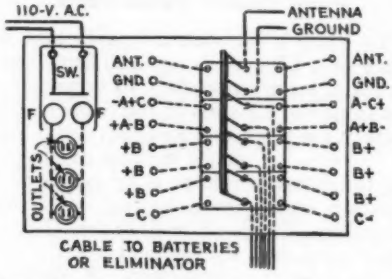


from the Radio Lab.

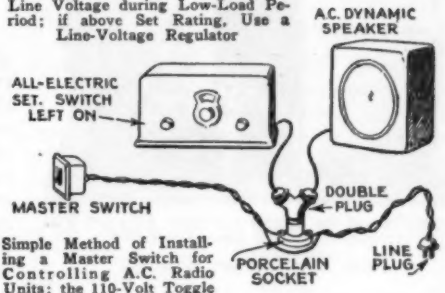


A Handy Lid Holder for the Home-made Radio Cabinet May Be Easily Made from a 10-Cent Folding Metal Rule; Two Sections and One Hinged Joint Are Employed, the Length Being Varied to Suit the Cabinet

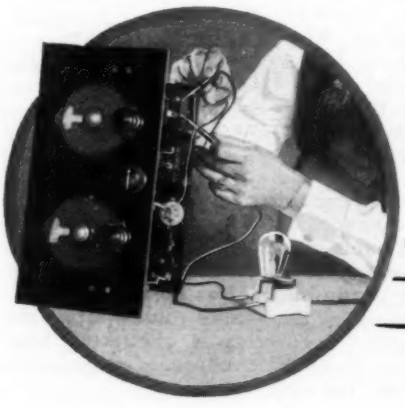
To Insure Long Tube Life When Installing A.C. Receivers, Measure Line Voltage during Low-Load Period; if above Set Rating, Use a Line-Voltage Regulator



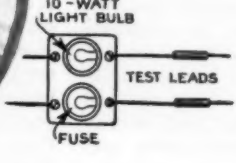
Above, Power Outlets from Fused Switch Block for B-Eliminator, Trickle Charger, etc.; Also an Experimenters' Double-Outlet Board



Simple Method of Installing a Master Switch for Controlling A.C. Radio Units; the 110-Volt Toggle Switch May Be Mounted at Any Convenient Point



A Simple Continuity Tester for Coils and Transformers, Made from a Porcelain Fuse Block Connected to the 110-Volt Line through a Light Bulb; If the Bulb Lights, the Circuit through the Winding Is Complete



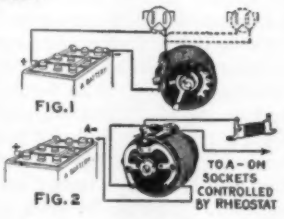
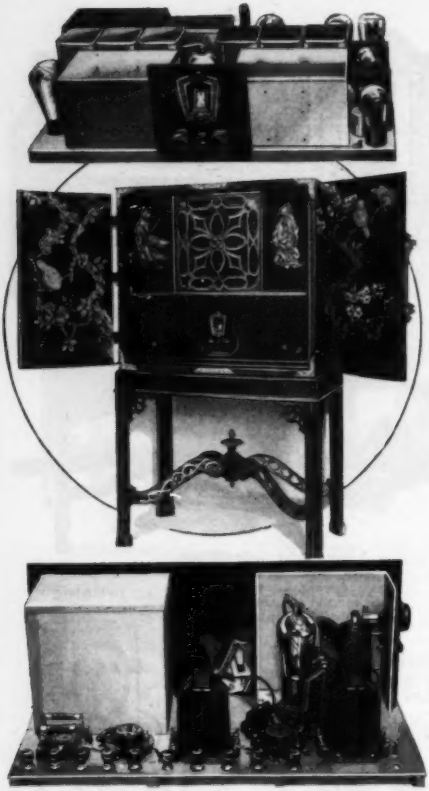


Fig. 1 Shows the Method of Connecting an Ordinary Rheostat in the Filament Circuit to Control the Voltage to One or More Tubes; Fig. 2 Gives Connections to a Combination Rheostat and Filament Switch; the Fixed Resistor Strip Limits the Voltage to Tubes Other Than Those Which Are Controlled by the Rheostat



Above, Two of the Newest and Most Advanced Kits for the Custom and Home Set Builder

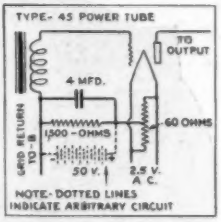
New Kits for Set Builders

Several outstanding kits, two of which are shown in the accompanying photos, have recently been announced. Complete down to the last screw and nut, they offer a means of quickly assembling circuits of advanced design. The 9-tube receiver at the top of the illustration includes a line-voltage regulator and six tuned circuits, consisting of a tuned 3-stage band-pass filter and a 3-stage tuned screen-grid r.f. amplifier. The audio unit consists of a power amplifier employing 45-type tubes in push-pull and a phonograph connection. Auditorium volume is available without distortion, and the specially designed power pack delivers humless full-wave rectification. Other features are one-dial centralized control and wired-unit construction to facilitate quick and accurate assembly. Tubes, coils and condensers are shielded individually and collectively with special attention given to circuit isolation to prevent interaction. One or more units may be purchased, or all equipment for a complete receiver or tuner for either a.c. or battery operation. This kit is suitable for installation in the finest of cabinets, like the red-lacquer Chinese Chippendale console shown in the illustration. The fitting of the set into such cabinets is very simple, as the receiver is merely pushed into the set compartment against an opening cut in the wood front panel for the controls.

The kit below the console is a short-wave receiver designed to operate on alternating current. Additional features are a tuned screen-grid stage, double shielding and a 14 to 500-meter wavelength range obtained by means of plug-in coils. It employs a special type-227 tube for use in the detector stage.

Using Type-45 Power Tubes

To equip a set with a type-45 tube in place of a 171-type is not a difficult matter; it is merely necessary to arrange for the supply of 2.5 volts to the filament, 250 volts to the plate, and a negative grid bias of 50 volts. A simple method of obtaining the filament voltage is by means of a separate transformer, having a 2.5-volt secondary. The 5-volt leads to the 171-tube are clipped, and the filament posts wired to the 2.5-volt transformer. A variable center-tapped resistor of 60 ohms is connected across this winding as shown in the diagram. The negative grid bias may be obtained in either of two ways. The preferred method is by the plate-current drop across a 1,500-ohm resistor, by-passed with a 4-mfd. condenser. However, if the plate voltage available is less than 300, it is usually better to furnish the bias by means of a C-battery, as the biasing voltage across the resistor is necessarily subtracted from the available plate voltage.—George Lewis, New York City.



Combination AC-DC Tube Checker

by A.O. Davison

THIS tube checker, built from odds and ends found around the experimenter's workbench, will enable the user to pick out good, fair and poor tubes of both the a.c. and d.c. types.

The meters are of an inexpensive type and the switches were obtained from a dealer in discarded telephone-switchboard apparatus. These switches are of the toggle type but are shown in the wiring diagram as ordinary knife switches to simplify the layout, and, of course, small switches of the latter type may be used if desired.

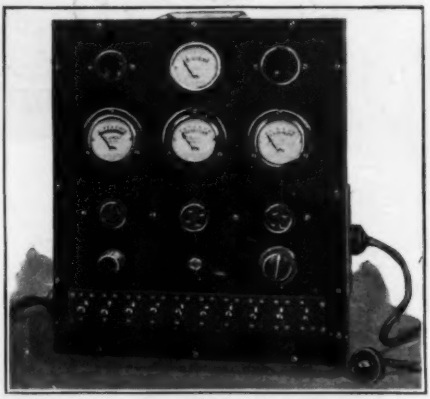
The cabinet is very simple, and may be made of any wood that happens to be handy. Two pieces, ½ by 11 by 5 in., are required for the top and bottom; the sides consist of two pieces, ½ by 14 by 5 in. The back is 11 by 13 in., and may be of thinner material. The front, or instrument panel, is bakelite, 3/16 by 12 by 14 in. in dimensions.

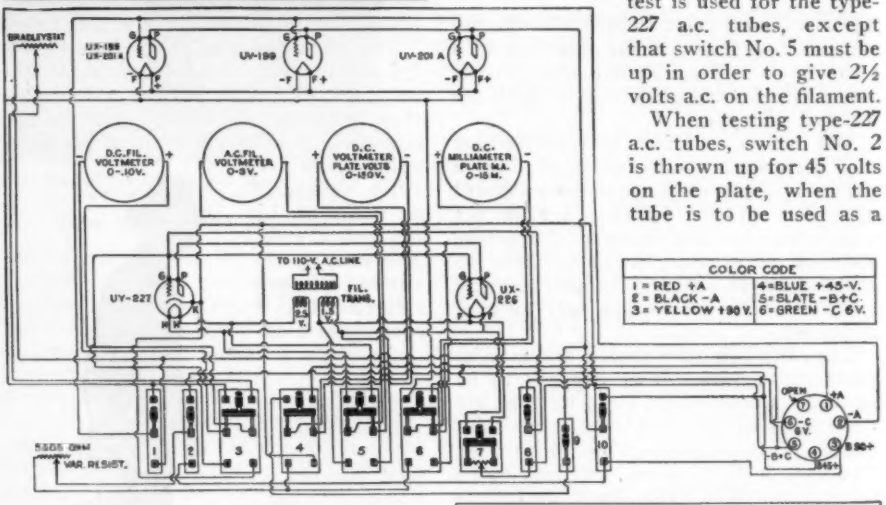
Subpanel-mounting tube sockets are used for the various types of tubes indicated in the diagram. A hole is drilled in the left side of the cabinet for the battery-connector plug and a wall-plate receptacle is mounted on the right side of the case for the power connection to the filament-heating transformer for the a.c. tubes.

The transformer is of the type having 1½ and 2½-volt secondary windings. The voltmeter and milliammeter ratings are clearly shown in the diagram, and the battery-cable connector plug is of the usual seven-conductor type, connected as indicated by the color code. The variable resistance across switch No. 7 consists of a 10-

ohm potentiometer, and the other resistors are as indicated.

Flexible rubber-covered wire should be used for all connections and all joints carefully soldered. The biasing voltage for d.c. tubes is taken from the 6-volt battery, and the table shows the actual readings obtained with the B-voltages indicated.





COLOR CODE	
1 = RED +A	4 = BLUE +45-V.
2 = BLACK -A	5 = SLATE -B+C.
3 = YELLOW +90 V.	6 = GREEN -C 6V.

Combination Tube Tester, Showing Arrangement of Panel; Simplified Wiring Diagram, Color Code and Tube-Comparison Table

For testing d.c. tubes, be sure that the Bradleystat is turned entirely off before inserting the tube in the socket. Switches No. 3, 4 and 6 must be in the up-position. Turn the Bradleystat to the right until the required filament voltage appears on the filament voltmeter. Switch No. 10, in the up-position, puts 45 volts on the plate of the tube; in the down-position, it places 90 volts on the plate. By closing switch No. 9 the plate-voltage reading appears on the plate voltmeter. Now note the reading on the milliammeter by throwing switch No. 1 down, which puts a positive charge on the grid. The milliammeter should now give a higher reading than that obtained by switch No. 1 in the up or negative-bias position. It is then a simple matter to find the quality of the tube by subtracting the first milliammeter reading from the second, and referring to the table. Use the same method for all types of d.c. tubes.

For testing the type-226 a.c. tubes, switches Nos. 2, 3, 4, 5, 6 and 7 are kept down. Switch No. 8, up, puts a negative bias on the tube, and down places a positive bias. The biasing voltage is obtained by using a separate 6-volt C-battery. When the grid has a negative bias, it will read on the filament voltmeter. The same test is used for the type-227 a.c. tubes, except that switch No. 5 must be up in order to give 2½ volts a.c. on the filament.

When testing type-227 a.c. tubes, switch No. 2 is thrown up for 45 volts on the plate, when the tube is to be used as a

TUBE COMPARISON TABLE						
PLATE-CURRENT READINGS IN MILLIAMPERES				TYPICAL PLATE CURRENT WITH BIAS ON GRID FOR GOOD TUBES		
B VOLTS	TUBES			ON GRID		
	GOOD	FAIR	POOR	-BIAS	+BIAS	
45 90	1.5 5.5	1.0 4.5	.5 1.5	1.6 5.5	6.5 13.0	UX OR UV 201-A OR SIMILAR TUBES
45 90	1.6 4.6	1. 3.8	.5 1.4	1.6 4.6	4.0 7.8	UX OR UV 199 OR SIMILAR TUBES
90	3.	2.5	1.8	3.	8.6	UX-226 OR SIMILAR TUBES
45 90	1.2 4.8	3.6	2.6	1.2 4.8	5.8 12.2	UV-227 OR SIMILAR TUBES

detector, and down for 90 volts on the plate, when it is to be used as an amplifier.

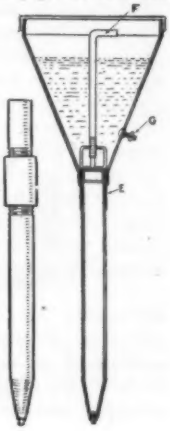
To find the amplification factor, note the reading on the milliammeter with negative charge on the grid, then note the difference when a positive grid charge is applied. Return the setting of the grid-test switch to negative charge, then find the change in plate voltage that will cause the same change in plate current. This is done by varying the 5,000-ohm resistor, the change in plate voltage being greater than the change in grid voltage. Divide the voltage change in the plate by the voltage change in grid to obtain the amplification factor of the tube.

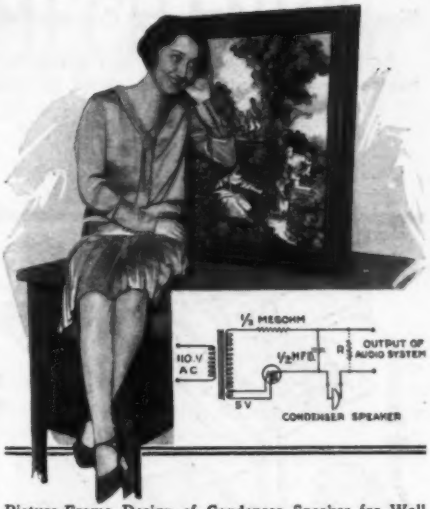
To find plate resistance, divide the value of the plate voltage by the plate current drawn by the tube. Reading of the milliammeter is taken with the grid negative.

To find plate impedance, divide the change in plate voltage by the change in plate current that it causes. When both the amplification factor and plate resistance of the tube are found, the mutual conductance in mhos, which is the reciprocal of ohms, equals the quotient obtained when the amplification factor is divided by the plate resistance.

New Device Provides a Wet Ground

The device shown in the sketch insures a good wet ground for the radio receiver. In dry or sandy soil, where a wet ground connection is rather difficult to maintain, this device fills a real need and is simple to install. The jointed pipe at the left contains a cotton wick which extends beyond the pointed end below. The pipe is driven into the ground and the driving cap at the top removed. The copper tank is then screwed on at E, and filled with water; the needle valve F permits regulation of the flow to keep the cotton wick saturated at all times. The ground wire from the radio receiver is connected to the binding post G.





Picture-Frame Design of Condenser Speaker for Wall Installation, and Diagram of Speaker Hookup

Tapestry Picture Is Condenser Speaker

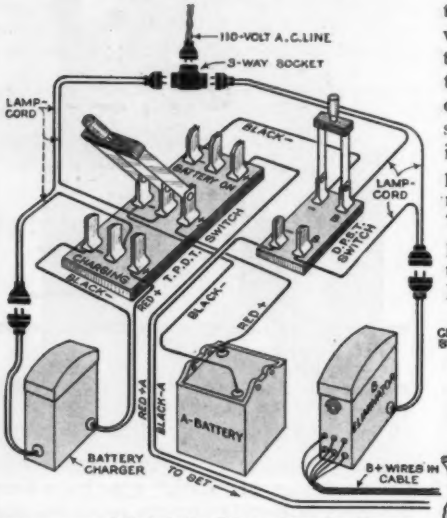
For a number of months speakers of the condenser or "static" type have been available in certain console receivers, and now the manufacturers have designed a speaker of this type installed in a neat tapestry-covered frame for wall installation. The tapestry in no way interferes with the radiation of sound, and the frame serves as a baffle to force the longer sound waves to radiate into the room. In a crowded modern apartment, this saving of space is of decided value, as the set can be relegated to an adjoining room or closet, if remote-control devices are used. A speaker installation of this type enables the user to obtain various acoustic effects. By hanging the frame in a corner the diverging walls increase the baffling and vary the resonance. The wall unit may be draped to cut off high frequencies.

Furnace Pipe Acts as Antenna

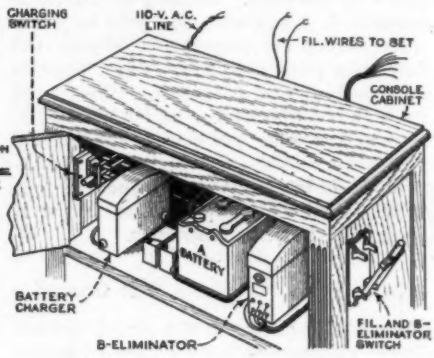
The pipes of a hot-air heating system often make a good antenna. Connect a lead from the antenna binding post on the set to the hot-air register at a point free from paint or enamel. Distant reception can hardly be expected from an antenna of this type, but it will do for locals when a temporary antenna is required.—G. Curtis Engle, Ridgewood, N. J.

Simplified Battery-Charging Connections

Arrange the power units in their compartment as shown at the right in the drawing, mark the various switch terminals plainly before starting the wiring and mount the switches as indicated. Use standard lampcord for the a.c. leads to the various plugs and for the leads from the A-battery to the switches. From the switches to the set, use well-insulated rubber-covered wire. The double-pole, single-throw switch for turning the set on and off is mounted on the side of the battery compartment or in any other convenient position. When charging the battery, this outside switch must be off, and the three-pole switch is thrown to the charging position. The usual filament switch on the front panel of the receiver is not used with this arrangement. By pulling out the three-way socket from the main-line plug, all units are disconnected. The switches used are of the standard porcelain-base type, not the small ones usually employed in radio circuits.—Henry S. Laraby, New Haven, Conn.



Arrangement of Switch for Battery-Charging Purpose and Installation in Cabinet

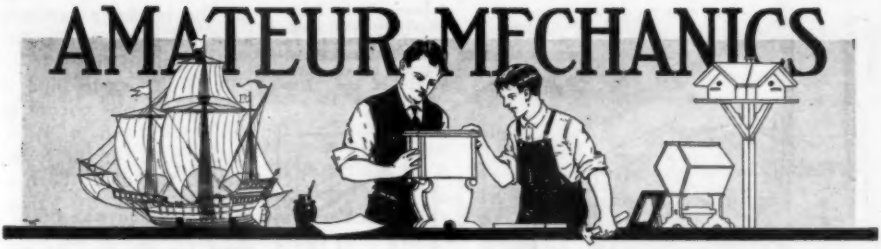


Homemade Soldering Flux

The best flux for soldering radio connections is, of course, one that will not corrode, and rosin is ideal for this purpose when properly handled. To make a rosin paste, melt two parts of rosin and then add one part of melted vaseline or enough to obtain the consistency desired. The rosin must be melted slowly and care must be taken to prevent it from burning, as the paste will not function as a flux if this happens. A safe way to melt the rosin is to use a sand bath, which diffuses the heat with less danger of scorching, although, of course, it would have to be watched. A good soldering fluid is made by dissolving a sufficient quantity of powdered rosin in denatured alcohol to form a thick liquid, which is applied to the parts to be soldered with a small brush. This solution can also be used as a binder to hold turns of wire in place on coils, as it dries quickly and leaves a hard layer of rosin which will not be affected by ordinary heat or handling. To determine if a commercial soldering paste is corrosive, take a piece of copper wire that is slightly tarnished and smear some of the paste on it. Allow it to remain on the wire for a day or two, then rub it off. If the surface is bright, the paste is corrosive and should not be used in a radio set.—W. H. Hardy, Albuquerque, N. Mex.

¶Popular Mechanics' radio department offers its information service free to all readers of our magazine. We will be glad to help you with your problems, and will promptly answer all inquiries.

AMATEUR MECHANICS



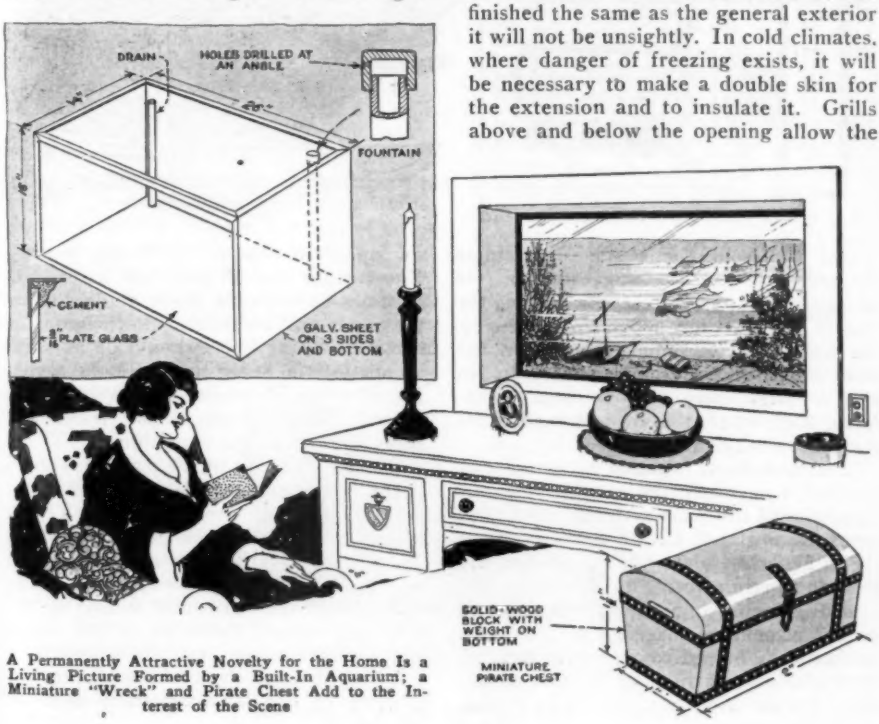
Built-In Aquarium Makes Living Picture

By HI SIBLEY

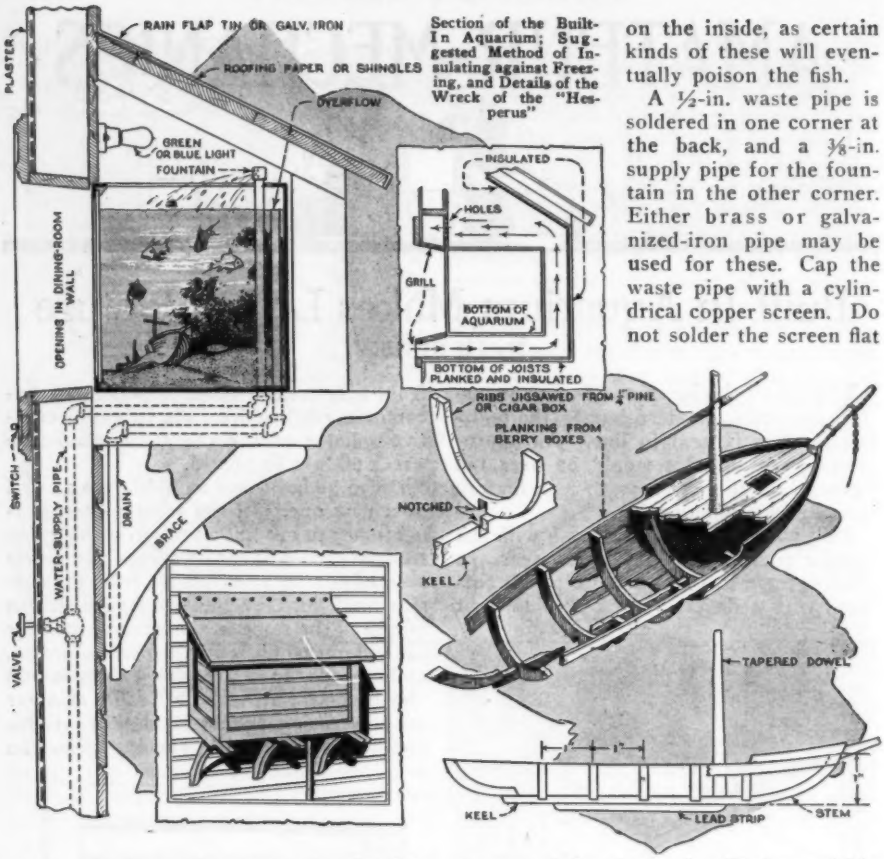
WITH all the ingenious devices incorporated in modern homes, the built-in aquarium is next in line. An appropriate place for this would be over the buffet in the dining room, or as a feature of a boy's bedroom or den.

Built with the glass front flush with the interior wall and framed like a seascape painting; the fish and aquatic plants suffused with a delicate green or blue light from a concealed bulb, it makes an uncommonly attractive item in the decorative scheme of the room. A miniature wreck adds to its appeal.

It can be built into an old house as well as a new one. In the former case, it is necessary to cut out a section of only one stud, as shown in the drawings. In either case, of course, an extension from the outside wall must be built to house it, but finished the same as the general exterior it will not be unsightly. In cold climates, where danger of freezing exists, it will be necessary to make a double skin for the extension and to insulate it. Grills above and below the opening allow the



A Permanently Attractive Novelty for the Home Is a Living Picture Formed by a Built-In Aquarium; a Miniature "Wreck" and Pirate Chest Add to the Interest of the Scene



Section of the Built-In Aquarium; Suggested Method of Insulating against Freezing, and Details of the Wreck of the "Hesperus"

warm air from the room to circulate around the tank, as suggested in the sketch on this page, effectively keeping the supply and overflow pipes from freezing. In California no such precaution has been found necessary. The aquarium, of course, might also be built into an interior wall, where the arrangement of the house makes this feasible.

The tank itself is made of heavy galvanized iron, reinforced at the top edges by angles of the same material. Only the front side is glazed, having a pane of about 3/16-in. first-class plate. If obtainable, use regular aquarium cement; if not, roofing asphalt, which is impervious to water, will do for cementing the glass to the tank. It should be heated to a gummy consistency and pressed in place in this condition. Do not use paint, varnish or shellac on the inside, as certain kinds of these will eventually poison the fish.

A ½-in. waste pipe is soldered in one corner at the back, and a ⅜-in. supply pipe for the fountain in the other corner. Either brass or galvanized-iron pipe may be used for these. Cap the waste pipe with a cylindrical copper screen. Do not solder the screen flat on top of the pipe as it will clog quickly. The cap for the fountain has a series of pinholes drilled at a slight angle so that the water will be thrown down upon the surface. These holes should be as small as possible in order to aerate the water. Introduction of minute air bubbles containing oxygen freshens the water and keeps the fish in fine condition.

The arrangement of the piping is shown in the sectional view. Note that the supply pipe runs up through the wall with a shut-off valve conveniently located on the inside. Overflow water can be used to irrigate shrubbery along the outside wall. Slope the horizontal section of the drain pipe toward the outlet, so that water will not accumulate here and freeze.

A hinged lid to the housing enables inspection of the tank, rearrangement of

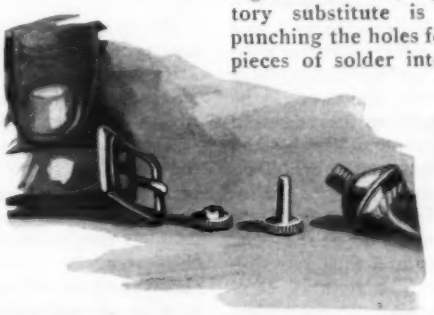
plants, etc., and periodical cleaning. Sediment on the bottom is siphoned off when necessary with a garden hose of sufficiently large enough diameter to carry away dead plant leaves, and the like.

Place the switch for the bulb in the frame of the aquarium. A porcelain wall socket makes a suitable fixture, and the bulb can be changed from the outside.

The plants and miniature shipwreck can be made very effective by placing the former in a semicircular background, concealing that wall of the tank and the pipes. Set the wreck to one side of the center in the foreground, partly buried in the sand, and the pirate chest near by. A miniature anchor and the usual seashells add realism to the submarine setting. Slope the sand toward the front. Incidentally, the sand should be washed thoroughly before the fish are put in.

The wreck is a very simple affair, consisting of a backbone or keel with stem and sternpiece nailed on with tiny brads. White pine is satisfactory material, since it is easily worked and does not split readily. A jigsaw is handy for cutting the curved pieces. Note that the ribs are mortised to the keelson. For planking, the thin wood used in berry boxes is suitable. The planks are nailed to stem and ribs with brads, and here and there the ends are broken off to carry out the wreck idea. Give the entire job a dark walnut stain or similar shade, attach bits of string and broken chain to mast, spar and stub of bowsprit. A strip of lead on the keel keeps the wreck submerged. Keep under water for two or three days to dissolve any injurious matter it may contain before putting it in fresh water with fish.

The pirate chest is whittled from a single block of white pine, and is stained and decorated with copper strips fastened with small escutcheon pins. It, too, should be provided with a lead weight on the bottom to keep it under the water. The weight may be recessed.



Wire Solder or Plug of Foil Tube Makes Substitute for Rivet When Repairing a Belt

Fireplace Tongs for Handling Large Logs

For handling large logs in the home fireplace, the tongs shown in the photo

Homemade Iron Tongs for Handling Large Logs in the Fireplace

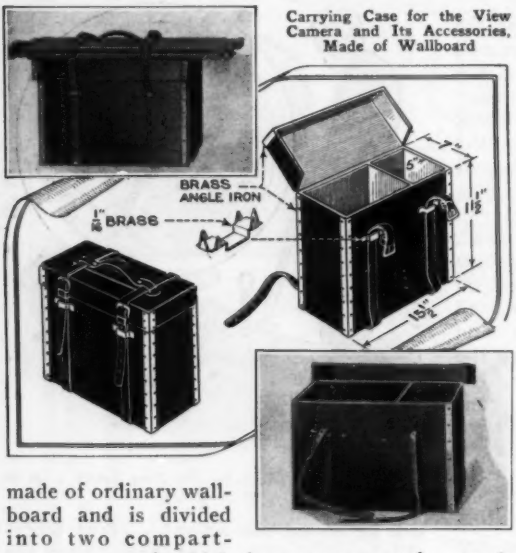
will be found convenient. Three pieces of iron are used to make them. They are bent over and pivoted as shown in the detail. One fork with its two tines extends to form a handle, while the other is U-shaped. To this a rod is pivoted so that, by manipulating the handle and rod, the tines can be drawn together and will then hold any log firmly.—Sam E. Vonner, Auburn, Me.

Wire Solder for Repairing Belts

When no rivets are at hand for repairing broken belts, a practical and satisfactory substitute is wire solder. After punching the holes for the rivets, slip short pieces of solder into the hole and hammer the ends down to spread them. If there is no wire solder available, a part of a tapered plug from a collapsible tube, as shown in the photograph, can be used as a substitute.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Carrying Case for the View Camera

For the view camera, the illustrated case has been found convenient. It is



Carrying Case for the View Camera and Its Accessories, Made of Wallboard

made of ordinary wallboard and is divided into two compartments, one of which is roomy enough for the plate holders, focusing cloth and other accessories, and the other for the camera itself. It can be made of any suitable size and the dimensions changed to suit the size of camera you have. The sides, bottom and ends are first cut and fastened together with strips of cloth, 1 in. wide. These are glued on, both to the inside and outside. The partition is likewise fastened in place, after which the cover is made, following the same method of construction. The cover should fit over the body. Both parts are covered with imitation leather or similar fabric to suit the builder. Corner angles can be purchased or they can be made of 1/32-in. sheet brass. If they are made, they should be about 2¾ in. wide to allow the edges to be turned under for neatness. Tack them on with small brass escutcheon pins. Two small, heavy staples are made of 1/16-in. sheet brass as shown in the detail. They are fastened to the front side of the box, about 4 in. from the top and the same distance from the ends. The pointed ends of the staples are inserted through slits cut in the side and are then bent over on the inside. Get a shawl strap and rivet it to the center of the top, which is glued on. Line the inside of the case with black cloth or other material for better protection against light.—Wm. J. Edmonds, Whitehall, N. Y.

Hints on Mounting Insects

The use of adhesive tape in mounting insects is a great time and labor saver and enables preservation of the specimens in a natural pose, which greatly improves the appearance. Cut the tape into very short and narrow strips of suitable size for each specimen. Place the insect on a card, spread the legs to their natural position and fasten a strip of tape over each. With this method of mounting, it is unnecessary to fasten the specimen with a pin through the body. To remove the specimen from the card, lift each strip of tape carefully to release the legs. The strips will be found not to stick to the legs unless they have been pressed down too firmly. If you wish to keep the specimens in envelopes, in the absence of a display case, mount them at one end of an oblong piece of stiff cardboard, and fold the other end over it, book fashion. The latter piece always tends to open up unless it is folded too sharply, thus providing plenty of space for the insect and protecting it against crushing.—Kenneth R. Deardorf, Bemidji, Minn.

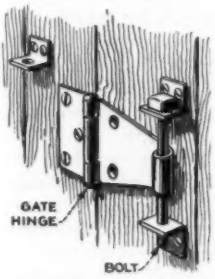
Decorating Glass and Pottery

By using various cheap articles of glass and pottery and some paint, unusual and attractive effects can be produced. The work is simple and interesting, and requires nothing more than a bucket of water and some small cans of quick-drying enamel of various colors. The bucket is filled with water and the paint, after each kind has been thoroughly mixed in its own can, is dropped on the surface of the water with a stick. It will be observed that a drop of red will not mix with a drop of blue or any other color dropped into the center of it, and that the various paints

may be drawn out into strings and ribbons without mixing. When the water has been thus covered with paint, take a jar or other article to be decorated, and dip it into the water, the work having been previously washed clean so that the paint will adhere to it. The paint will be attracted to the surface of the jar both when it is immersed and when it is withdrawn from the water, which will give it a coating beautiful in design. By revolving the work as it is being withdrawn from the water, diagonal and horizontal patterns can be obtained. The operation can be repeated as often as desired to get any suitable effect. From time to time more paint must be added to replace that used on the work. After the articles have been set away to dry, the paints will run together slightly at the edges, giving a "marbled" effect.

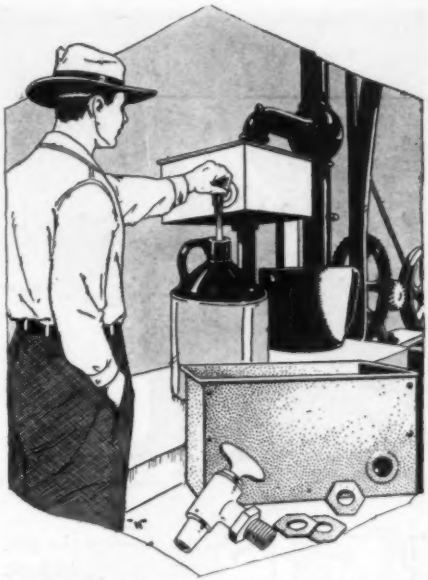
Door Lock Made from Old Strap Hinge

The ordinary plank type of shed door can be locked by means of a simple device made from an old strap hinge, as shown in the drawing. One part of the hinge is screwed to the door jamb while the tapered end is bent to form an eye through which a bolt can be slipped. Two small pieces of angle iron are attached to the door in line with the eye formed on the hinge, and a hole drilled through the angle brackets allows the bolt to be slipped through both brackets and hinge as indicated. This improvised lock will hold the door securely.—Erwin C. Schroeter, Chicago, Ill.



Quick Repair for Glasses

A quick emergency repair for a broken temple on a pair of spectacles can be made with a piece of rubber tubing of the kind used for auto-windshield wipers. Both broken ends are slipped into the tubing, which will hold them together firmly until a permanent repair can be made.



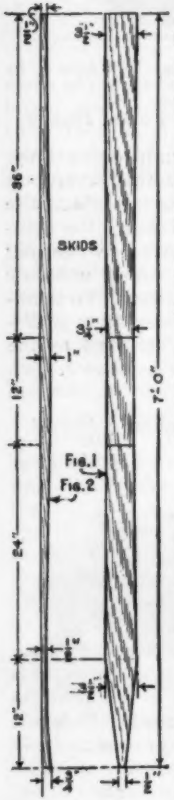
Old Faucet Attached to the Pump Tank Adds to Its Convenience

Faucet on Pump Tank Found Handy

On many farms the pump delivers the water into a small tank that overflows into a trough, which in turn conducts the water to a stock tank. During the summer months, when the kitchen water jug must be filled often, it is rather unhandy to dip the water out of the tank. To facilitate the task more, a faucet from a discarded separator can be attached to the bottom of the pump tank as shown.

Easy Method of Threading a Needle

Threading a needle, even a fairly large one, is frequently a tedious job if your eyes are none too good. The difficulty is removed if you proceed as indicated in the photo. Take a small piece of stiff white paper and hold it under the needle. This will provide a contrasting background and will enable you to see what you are doing.—F. W. Bentley, Jr., Missouri Valley, Iowa.



SKI tracks—up the hill, down the hill, in back lot and forest trail, from Maine to Oregon—ski tracks. Tracks made by people who know how to go after real sport when Jack Frost spreads his white blanket. Tracks that mutely speak of the pleasure and sport in "them thar magic slippers."

Going to try it? The first part of your job is to make the skis. Start by making the two paper patterns shown in Figs. 1 and 2. Then mount pattern No. 1 on a smooth, straight-grained piece of hickory, ash or birch, and with a keyhole or coping saw, cut away the wood which is not covered by the pattern, as in Fig. 3. Fasten pattern No. 2 in place on the side of the wood strip, and shave away the wood to the pattern's edge, as pictured in Fig. 4.

The next job consists in grooving the bottom (flat) side of the ski. This groove can be put in very easily and quickly with a grooving plane, but if you do not happen to be the owner of such a tool, you can do a workmanlike job by cutting out a piece of metal shaped as shown in Fig. 5, and then scraping with this piece down the center of the ski. A straight length of wood clamped into place serves as a guide line, as shown in Fig. 6.

You are now at the halfway mark in the construction of this ski, and about to take a crack at the important process of steaming it to the proper shape. This step consists in bending the whole ski as well as shaping the forward part of your wooden shoe. You will need a boiler or other large vessel which will hold water. Get this water boiling hot, and then place the ski in position over the rising steam. After about twenty minutes of this steam, swath the whole length of the ski with pieces of rags, and then pour over these rags quantities of boiling water. Keep it up for about thirty minutes, paying particular attention to the forward part of the ski, which will take the toe bend. Then, off with the rags and onto the bending frame. This consists of an ordinary stepladder, and the method of

Great Sport!

by Sam Brown

clamping the ski to the steps is shown in Fig. 7. The toe, as you can see, is slipped under one of the steps, and the balance of the ski is securely clamped down. The heel of the ski should be held about 1½ in. out from the step by means of a wood block so that the full length of the ski will be curved in a slight arch. Leave the ski in place for about forty-eight hours; it will then retain its shape permanently. You will, of course, bend the two skis at the same time in order that the toe bend and arch may be uniform.

Now for the binding. With a wood chisel, cut a long slot through the thickness of the ski, as shown in Fig. 8, locating the slot a trifle forward of the balanced center of the ski. Then cut from heavy metal a piece of the shape shown in Fig. 9, and by means of the four holes shown in the corners, rivet a piece of leather to one side of the piece. Insert the metal strip into the slot in the center of the ski, and then, by using a vise as in Fig. 10, press the ends of the strip upward. Remove the ski from the vise, and nail a 12-in. length of rubber tread into place for your foot to rest on.

The actual binding of the shoe to the ski is a matter of two straps—one to go around the toe, and another, lighter, to slip around the heel—as in Fig. 11. Finishing touches consist of staining and varnishing the upper part of the ski. The bottom should not be varnished, but should receive a liberal application of linseed oil followed by a paraffin rub.

FIG. 5

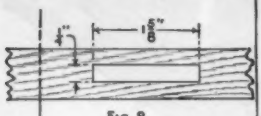


FIG. 8

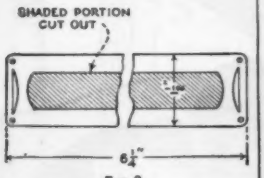


FIG. 9

Start by standing quite still for a few minutes until you get the feel of your huge "feet." Hold the skis parallel and close together. Your poles have been left at home, since they are not necessary in this first lesson. Now, push the right foot ahead, until the knee is bent just so far that, on looking down, you cannot see your foot. Your body is leaning forward. When it seems that you are headed for a pitch on your nose, push your left foot forward, and quickly straighten the right leg. Slide! Don't walk! Bear this in mind always, for it means all the difference between pleasure and work, and is the fundamental rule which must be mastered. Keep your skis flat on the snow.

You should do this initial practicing on a level piece of ground where a slight crust has formed on the snow. And keep at it! It would be grand, no doubt, to start at once by shooting down one of the steep hills on which you see other skiers enjoying themselves, but get that long, easy glide before you try anything more difficult.

After mastering running on the level on flat ground, you will be ready for a try-out on a slightly rougher surface. Get out the ski poles, and learn to use these to help yourself along with each stride. If two

Ski sticks are another essential in the equipment of the skier. A 4-ft. length of bamboo makes the best pole. Tightly wire a baby-buggy wheel, with hub removed, about 6 in. from one end of this, as in Fig. 12. The wheel end of the stick is capped with an iron spike set in rosin, while the opposite end of the stick is topped with a leather thong to fit over the wrist.

Now for the dirty work! To find yourself for the first time in your life standing on a pair of skis, a stick in either hand, and with no earthly idea of what to do or how to do it—that's the ultimate in feeling absolutely awkward. And when you finally do start, downhill, going like the wind, with a tree stump coming at you with cannonball speed—oh, for the comfort of the fireside, and the aroma of a good pipe, and the feel of soft slippers.

But it's soon forgotten. In no time at all you are zipping along in great style.

poles are used they can be either swung forward and backward alternately, or both swung forward at the same time. The alternating movement will come quite naturally if you will take care to set your poles as far ahead and as close to the skis as possible; but the correct manner of performing the double movement is a bit awkward. Here, you should throw both poles forward simultaneously, as in Fig. 13, taking two or three running steps at the same time, bending your body as far forward as possible and pushing with your whole weight on your arms until they are as far back as they will reach, as in Figs. 14 and 15. Bringing the poles back for a second stroke is the difficult part of the maneuver. They are not brought forward parallel to the skis as would seem natural, but are flipped outward, describing a half circle, from the tail to the tip of the skis, the ends of the poles barely clearing the snow.

13

14

15

After you get the hang of level running, try the hills. Funny thing about hills—you stand on the very brink of the slope, yet your skis do not at once commence to slide as you expect. So you jerk backward and forward a few times, and there! the skis bound joyously forward while you do not. Result: You do more or less skiing on various portions of your anatomy other than your feet.

Of course, there's a better way. It consists in running off with the skis before the skis run off with you. Get back a few yards from the edge of the hill and take a few sliding steps forward. Once you are headed down the slope, push one ski ahead of the other so that you will be better able to maintain your balance. Keep the skis close together; the expert skier never leaves a double track in ordinary downhill running. In going downhill, your poles should be held to the rear and a little above the snow surface. Keep your hands out of the leather loops so that you can let go quickly in the event of a tumble.

Going downhill is heaps of fun and all that, but hills do not forever go down, so it becomes necessary to learn something of the more arduous technique of

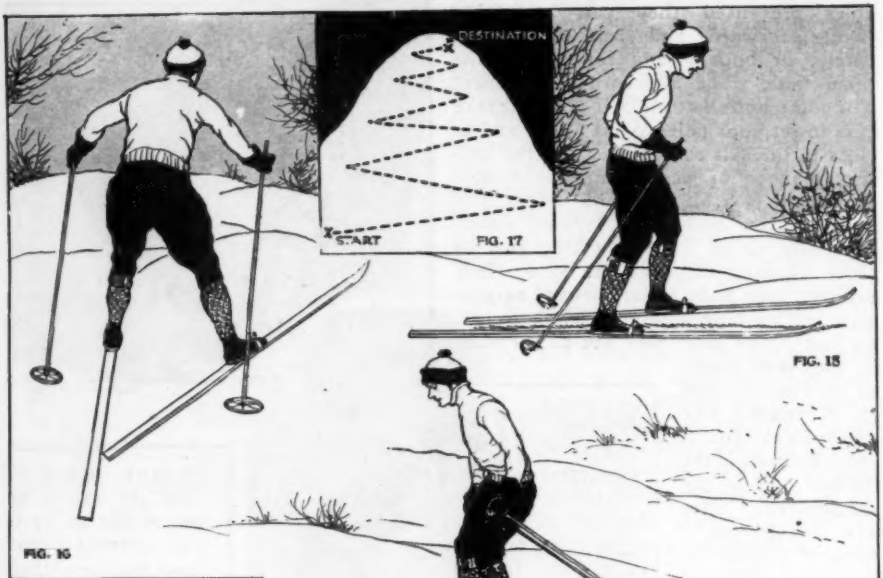


FIG. 16 FIG. 17 FIG. 18 FIG. 19

climbing up. If the hill is a short one and you feel full of pep, then you can use the speedy but strenuous "herringbone." Face uphill, push the skis, alternately, forward and outward, as in Fig. 16. Use the poles to help yourself forward. Make certain that the forward ski has a firm grip on the snow before you make the next step ahead.

A simpler, commoner and far easier way to climb hills is to tack. That is, you do not go directly up the face of the slope, but travel at an angle across its surface, as in Fig. 17, and by zigzagging back and forth in this fashion you eventually come to the top of the hill. In tacking, you use a step somewhat similar to that used in straight running, with the exception that the skis are lifted slightly at each step in order to make possible the uphill course, as in Fig. 18.

Whatever the method of getting uphill, the slide down again is surely worth the effort. If, on sliding downhill, you should attain a speed which seems too great, you can easily slow down by snowplowing. This consists in turning the skis in, and letting the inside edge of each of the wooden shoes bite into the snow, as in Fig.

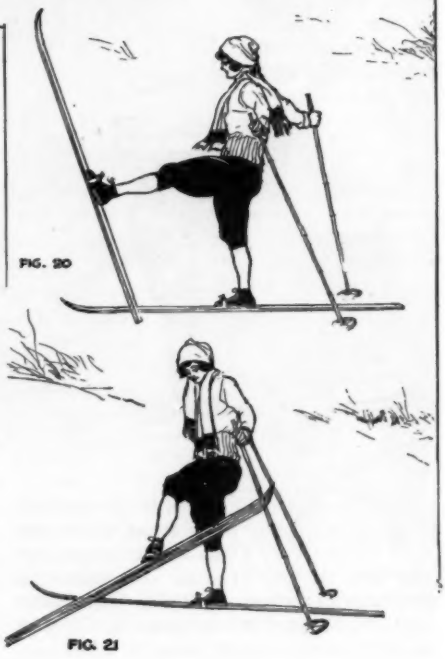


FIG. 20 FIG. 21

19. Knock your knees together. An emergency form of braking can be done by digging the poles sharply into the snow.

When you reach the bottom of the hill and wish to turn around, use the simple kick turn. This is done by lifting the point of one ski, say the left, until the heel rests on the snow, as in Fig. 20. Continuing the movement, the left ski is turned out and back until it can be brought down, point to heel with the right ski, as in Figs. 21 and 22. The rest of the turn consists in lifting the right ski high, wide and handsome, so that it can be swung over the left ski and into position.

Naturally enough, there is a lot more to skiing technique than the few principles mentioned in this short article. Straight running, swooping down hills, and snailing up hills, however, are more than enough for the average beginner.

Ski games and stunts, too, can be enjoyed by any beginner. Of these ski diversions, perhaps ski-kjoring is the most popular. This calls for a length of rope, and a "hoss," motorcycle or automobile, as suits your fancy. Ski-kjoring behind an automobile seems to have the preference in this country. Learn the snowplow, as pictured in Fig. 21, before you go ski-kjoring, as it is a very necessary maneuver when you find yourself, on hills especially, going faster than the car ahead.

Obstacle races, in which the skier is required to pass through five or six open-ended barrels, furnish considerable fun for both contestants and spectators. A two-legged race makes for another good laugh. A man and a woman make up a team. The man takes off his left ski, and the woman her right. Now, holding to each other, as in Fig. 23, they slide downhill with the free foot in the air. Distance, of course, is the sole object. And try shooting downhill in tandem formation or in the horseback fashion shown in the headpiece.

Believe it or not—there's lots of fun waiting for those who tread the winter snow on magic slippers.

Putty for Filling Nail Holes

Putty should not be used for filling nail holes, etc., on work to be finished with flat white paint or white enamel, as the linseed oil in the putty will penetrate the paint and cause yellow spots. A much better filler is the paste found on the bottom of a fresh, unstirred can of flat white paint. Put some of it on a glass plate and add whiting to make a satisfactory putty. Only enough of this composition should be mixed for immediate use, as it dries very hard. It sticks like glue and does not shrink, crack or stain the paint.

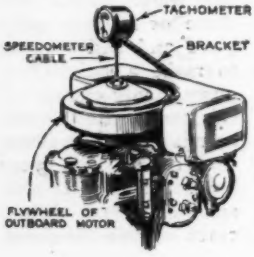
Dirt Tampers for Feet Do Work of Lawn Roller

Wooden Foot Tampers Used to Pack Down Soft Dirt in the Absence of a Lawn Roller

After preparing and leveling off the black dirt on my lot in the preparation of a lawn, a roller was not available, and I made a pair of foot tampers to use as a substitute. They were made of 1-in. stock and measured 10 by 14 in. in dimensions. While standing on them, I drove two small nails on each side of each foot and tied a length of heavy twine from nail to nail across the shoe to hold the tampers. —John Hessemer, Seattle, Wash.

Speed Indicator for Outboard Motors

When the outboard motor is put up for the winter, it is a good time to overhaul it and provide such extra fittings as may be desired. One of them, which can be installed by the owner, is a speed indicator. A tachometer, or instrument indicating revolutions per minute, can be made from an automobile speedometer of the fly-ball type. Remove the mileage-counting arrangement, leaving the fly ball and the pointer. You will note that the fly-ball ring has a slight spring tension applied to restore it to its normal position and keep it from becoming horizontal out of proportion to the speed. Bend this spring with a pair of small pliers so that the tension will be slightly greater than it was originally, then remount the indicating face of the speedometer and paste a disk of white paper over it. Draw an arc for a scale on the paper, but leave it otherwise blank. Take the tachometer to any automotive electric shop and have the scale graduated according to a standard tachometer used for checking generator and engine speeds. The completed instrument is mounted on the motor by means of a strap-iron bracket so that its driveshaft comes exactly over the center of the motor flywheel. The two are then connected with a short piece of speedometer cable.—D. A. Brown, Marion, O.



Asbestos Curtain for Gasoline Lantern

A gasoline lantern, set on the floor of the tent, will provide sufficient heat to make the interior comfortable at night, but there are times when the brilliant light is not desired. To reduce this, yet retain the heat, provide an asbestos curtain for the lantern as shown in the drawing. Woven asbestos cloth should be used for this purpose. When not in use, the curtain is rolled up and put away, or slipped around the base of the dome. Such a curtain will be appreciated by fishermen and hunters, as well as campers.—Durfe Rockwell, Hollywood, Calif.

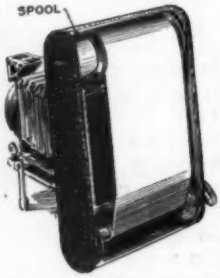
¶Keep the spark plugs adjusted to the gap specified for the car. Do not guess at the distance, but use a gauge to test the length of the gap.

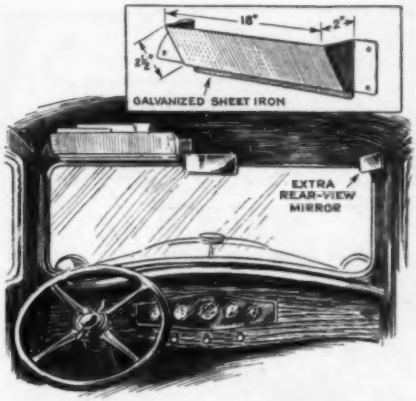
Improving the Oil Cookstove

In our vicinity, where gas for cooking purposes is not available, we use an oil stove. It has all the good features of the numerous makes on the market, as I have taken a tank from one, leveling legs from another, burner lift from a third, and so on, combining all these parts to make a better stove than any one of the contributing types. The idea proved successful. There is one objection I had to all of the stoves, which I have also corrected. The lighting ring is usually of ordinary tin-reinforced asbestos, and these carbonize in a comparatively short time, making it necessary to replace them. I used discarded auto-brake lining for the asbestos wick and found it would last about six times as long as the commercial kind. Heat the lining red-hot to burn off all the grease and oil, and after it has cooled sufficiently, cut it to fit the stove burner. It may be necessary to flatten it with a hammer in order to make it fit.—Sidney Cornell, Southport, Conn.

Using Narrow Film in Camera

A photographer found himself out of film at a time when it was absolutely necessary to get certain pictures. The local drug store did not carry the size of film required but did have on hand narrower rolls of the same length. After a moment's reflection, the photographer adapted the narrow size to his camera by attaching a small wooden spool at one end of the narrow film spool as shown in the illustration. To do this, a notch was cut at one end of the spool and a number of matches were driven into the other end so that this could be wedged onto the film spool. A standard spool was cut to the required size. After the film was exposed and wound on a large-size film spool, it was removed from the camera in subdued light and immediately wrapped in tinfoil.





Maps and Other Papers Are Convenient, Kept in This Sheet-Metal Container

Handy Map Holder in Car

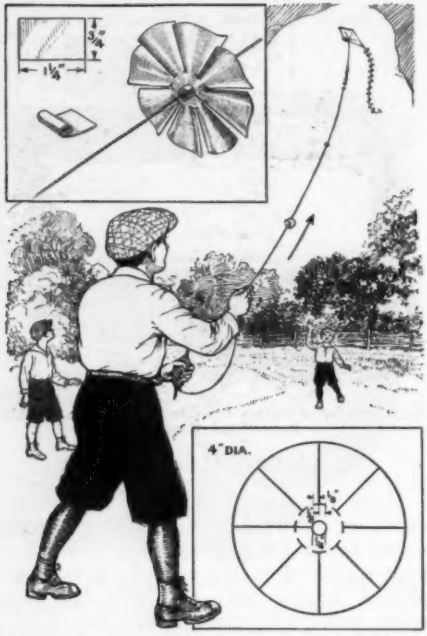
Made of galvanized sheet metal, the container shown in the drawing has been found handy for holding maps and other papers carried in the car. It is trough-shaped, having only one side and two ends, and is attached above the windshield by driving a few short woodscrews through the extending ends. These are then bent over flush with the surface. Another accessory I find convenient is an extra rear-view mirror, mounted in the angle at the right-hand side of the windshield. This shows when another car pulls out to the left to pass me.—S. M. Hunt, Prague, Okla.

Improvised Cake Tins

When baking a number of cakes at one time, and not having enough small tins, I took a rolled-oats carton and cut it to the height of the tins. These I set in pie tins, greasing both the tins and the cartons, after which the dough was put in and baked, with perfect results.—Mrs. Eleanor Durr, Portland, Oreg.

Finding Leak in Basket-Ball Bladder

To find a leak in a football or basket-ball bladder, remove it from the casing, inflate it to normal size, and hold it up to the light. This stretches the rubber so that one can see blemishes and small holes easily.—R. P. Deneen, St. Cloud, Minn.



Circular Disk with Numerous Blades Makes a Speedy Kite "Message"

Sending Aerial Messages to the Kite

When flying kites it is quite customary to send "messengers" up to the kite. Quite an improvement over the usual form is shown in the drawing. Cut a disk about 4 in. in diameter from a piece of light cardboard and make radial cuts as indicated in the detail, being careful to follow the dimensions given. Then roll up a narrow strip of paper to form a bushing which is pushed through a hole cut in the center of the disk. The sections are bent outward to form blades and the device is slipped on the kite string. It is amusing to see how fast these messages climb up the cord toward the kite.—Douglas H. King, Irvington, N. J.

Cutting Ice-Cream Containers

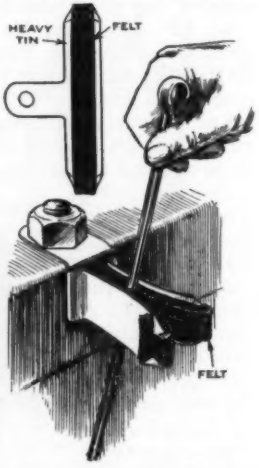
It is often quite a task to remove ice cream from a paper container by the usual method of first letting it melt a little and then digging it out with a spoon. The following method eliminates this trouble: Cut the container, with the ice cream in it, in the same way as you would cut a cake. The container, with the lid closed, is laid on its side and slices of any width can be cut with a sharp knife. To serve, merely slip off the paper "rind." This method has been found especially useful with cylindrical containers.

Hanging Two Tiers of Garments in the Wardrobe

Placing the coat hangers on a rod supported by cleats on opposite walls of the wardrobe is the usual method of disposing of garments with the least waste of space. A second tier may be hung by arranging a rod near the ceiling and nailing staves on the coat hangers to be used on the top rod. Thus the garments can be hung up and removed without the use of a stepladder.

Handy Oil-Gauge Wiper

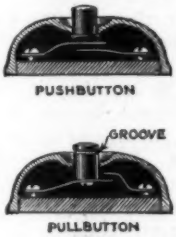
Keeping a rag under the hood of your car for wiping off the oil gauge is poor practice, owing to the possibility of the rag igniting if it comes in contact with the exhaust pipe. On the other hand, a greasy rag cannot very well be kept any other place about the car. To have a wiper handy without these objectionable features, I installed the one shown in the drawing, and found it entirely satisfactory. It consists of a piece of heavy tin, cut to a T-shape and then bent over to form a clip. Before bending it, a strip of heavy felt is attached by crimping the corners over as indicated. In use, the gauge is drawn between the wiper, which is attached to the motor near the oil gauge.—A. C. Wilson, Columbia Cross Roads, Pa.



Straightening Warped Boards

Lumber as it comes from the mill to the amateur woodworker is not always properly seasoned, or, if it has been resawed to thickness, the moisture content of the inside of the original board, being greater than that of the outside, often causes the resawed board to warp or curve. When you receive your wood, store it so that it will stay flat, weighting it if necessary to keep it so. If, in spite of precaution in storing, you find a board warped, it can often be straightened by holding the concave side over the steam from a kettle for a few minutes, and then exposing the convex side to hea . The moisture absorbed by the concave side will expand the cells on this face of the board, while moisture will be extracted from the cells on the convex side by the heat. With a little coaxing the board can usually be flattened. Then it should be laid on a flat surface and weighted to keep it in shape until it is to be used.

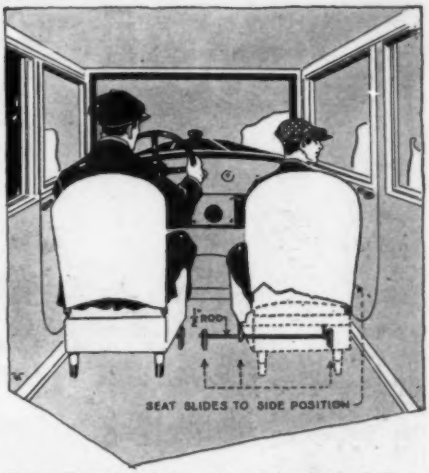
Eliminating Doorbell Annoyance



A semi-invalid who found it annoying and difficult to answer the doorbell time after time only to find peddlers and agents there, had a simple change made in the pushbutton so that it had to be pulled instead of pushed in order to ring the bell. As the secret of its operation was only given out to friends, no more trouble was experienced, as pressing the button had no effect. A small groove turned in the button helps to hold it. The illustration clearly shows how the mechanism inside was changed.—Harold E. Benson, Denver, Colo.

Improving the Seating Arrangement in Two-Door Sedan

In many two-door sedans there is quite a bit of space between the front seats which can be utilized to advantage, as shown in the illustration. The right-hand seat is mounted on a steel rod so that it

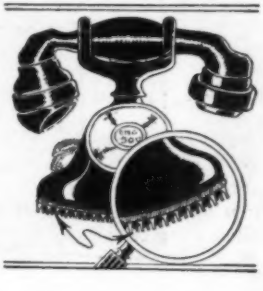


Sliding Front Seat in Two-Door Sedan Makes It Easier for Occupants to Enter and Leave

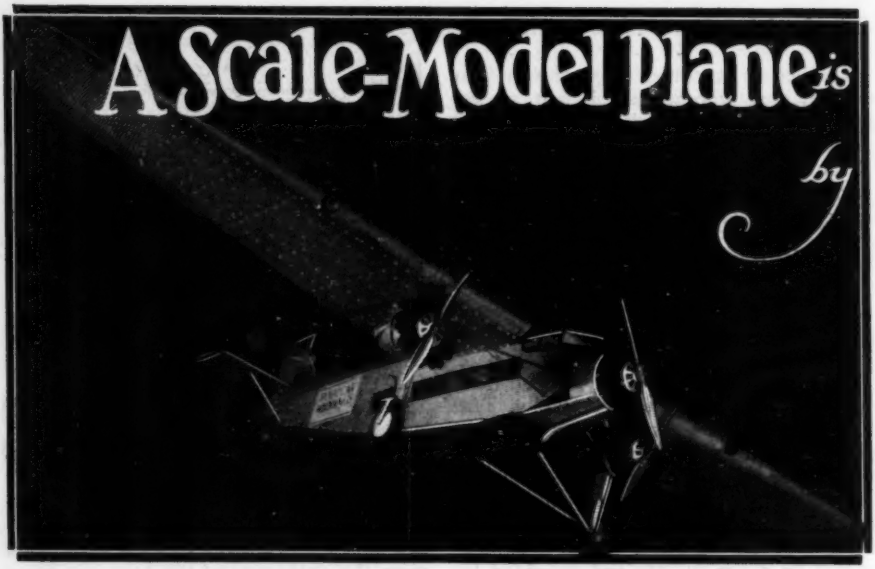
can be slid toward the driver's seat. This gives the occupants of the rear seat more room to get out of the door, by sliding the seat to the left. Remove the pins from the front legs of the seat on which it hinges, and ream out the holes on both legs and supporting brackets to receive a piece of ½-in. cold-rolled steel. The right-hand bracket must be moved closer to the car wall, and the other one close to the driver's seat, while the rod must be long enough to allow maximum movement of the seat. The rear-seat passengers get out between seat and door, without the front passenger leaving his seat.—John L. Blaker, West Auburn, Mass.

Rubber Base Prevents Sliding of Phone

To prevent a desk phone from sliding, get a rubber coin pad of the type shown in the illustration and glue it to the underside of the base. There will be no more trouble. It takes only a few moments to apply a rubber pad, which can be bought at any rubber-goods store.



A Scale-Model Plane is by



NEXT in order is the job of assembling the engines. The Pratt & Whitney "Wasp" motors of this ship are the familiar nine-cylinder, air-cooled, radial type. The lead die castings made for the model cylinders are an exact replica of the latest Wasp design. They are mounted at angles of 40 degrees to each other on the engine nacelle.

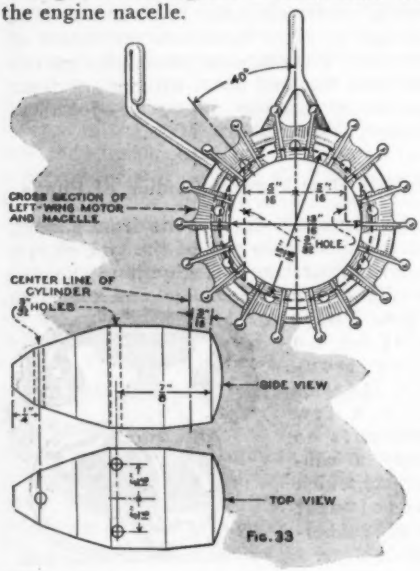


Fig. 33

Referring to Fig. 32, in the preceding chapter, you will see the nacelle tapers at the front, where the cylinders are to be mounted. Mark a line around the nacelle, 3/16 in. back from the front edge, as shown in Fig. 33, as a center line for the cylinders. If the nacelle is exact size, the diameter on the line will be 7/8 in. Anyway, caliper the exact measurement, lay out a circle of the same size on paper, and draw nine radial lines 40° apart. Adjust a pair of dividers to one of the divisions, and step the distance off on the nacelle, checking to see if it comes out even; then mark the points for the cylinders.

The nacelle should now be drilled to take the supporting and landing-gear struts. Selecting one of the cylinder positions as the top of the nacelle, draw a line lengthwise of the block, passing through the cylinder point. Referring to the side view, Fig. 33, measure 7/8 in. back from the nose, and 5/16 in. from the center line, on either side, to locate the forward supporting struts. The inside hole is drilled entirely through the nacelle, the lower end of the hole taking the landing gear strut. As one nacelle is left-hand and the other right, the holes must be on opposite sides of the two engine mounts. A 3/32-in. drill is used. Next, 1/4 in. from the tail, drill the other 3/32-in. hole, on the top center line,

Easy to Build

Walter Bullock

for the rear strut, about halfway through the block.

The cylinders must be rounded to fit the nacelle surface, and also tapered fore and aft, as shown in Fig. 34. The cylinders are cast with the curve in their base, but must be tapered by cutting the soft lead with a knife, maintaining the curve at the same time.

Drill a No. 60 hole vertically through each cylinder, to take the brad by which they are fastened, and a hole, 1/16 in. in diameter and about 1/8 in. deep, in the rear side, to take the end of the exhaust pipe. The back of the cylinder, Fig. 34, has the intake manifold cast on and, opposite its upper end, a small flat place where the exhaust outlet is to be drilled. On the bottom of the cylinder is a small casting lug. Cut this off, mark the center, and drill lengthwise for the brad. A small hole cut in a block of wood will hold the cylinder fairly steady and eliminate marring of the cooling fins. Centering the hole in the bottom is imperative if the cylinders are to line up properly.

With all cylinders drilled, you are ready to assemble the first engine. Fig. 34 shows the center line, which is to be kept at right angles to the crankshaft line, or center of the nacelle. Cut away the lead until you get a good fit, keeping this line at right angles to the longitudinal axis of the nacelle, and with the cylinder in a radial line through the shaft position. A brad, through the cylinder and driven a short distance into the nacelle, will aid in this. When correct, nail the cylinder on and proceed to the next one. A convenient jig to keep the nacelle lined up fore and aft and protect the cylinders already in place as more are added can be made by drilling a 15/16-in. hole 1 3/8 in. horizontally into a block of wood. The hole will just fit the thickest portion of the nacelle and hold it firmly. Both wing and nose motors are assembled in the same way. The top cylinder of the nose engine is placed on the center line of the nose, as with the wing engines.

The exhaust pipes and ring, Fig. 35, come next, and when they are in place, the cylinders will be firm and rigid. The

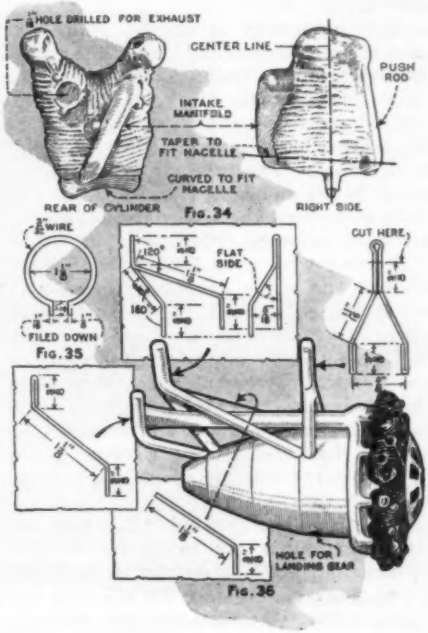


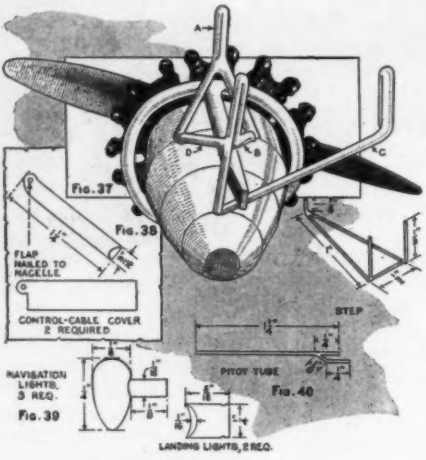
Fig. 34

Fig. 35

Fig. 36

short "pipes" from the holes drilled in the cylinders to the ring are made from 1/16-in. wire. Cut seven short pieces that will fit in the holes and project 1/8 in. to the rear of the cylinders. Standing the nacelle on its nose, solder each in place. None are needed in the two bottom cylinders.

The ring is formed from 3/32-in. wire, and should have an inside diameter of 1 1/8 in. At the end of the rod, 1/4 in. is bent at right angles to form the connection to one of the two bottom cylinders. This portion is filed down to match the other connecting pipes. The opposite end is bent and cut to fit the other cylinder, and the end filed down to match. Solder the outer ends of the short pipes to the ring, and smooth down all joints with a file.



The supporting struts, by which the nacelles are suspended beneath the wings, are made from 3/32-in. cotter pins, 2 in. long. Full details of the left-wing nacelle supports are shown in Fig. 36. The forked part at the right is the same for both wings. The other three pieces are made in left and right shapes. After you have completed the left-wing mount, the right will offer no difficulties.

Starting with part A, Fig. 37, file the ends of one of the 2-in. cotter pins off to equal length, spread them far enough apart to handle each side with the pliers, and bend over 3/8 in., to form full rounded ends, which may be soldered. Next bend the 1 1/16-in. legs, squeeze the shanks back together with the pliers and solder, then cut off the head, leaving a 3/8-in. shank to be soldered into the wing. Two pieces are made exactly alike.

For the piece behind this, part B, straighten out a pin to its full length, hammer out the bends and start with the lower rear leg. Holding the pin with the pliers in the right hand and the flat side of the pin toward you, bend it to the left to form the 160° angle. Bend the upper shank back to the right parallel to the lower one, then double up the pin, as in the front view. The doubled portion is soldered. The long end of the pin is bent forward and upward to form the 120° angle, and the forward end downward and clipped off to a length of 3/8 in. The forward strut is then bent outward to form one side of the forward brace. Piece C, which forms the other side of the brace, is bent with the flat side of the pin inside. The fourth support, D, has a 3/8-in. shank at the bottom, and is soldered to the rear shank of B. When the straight fork A is completed, force it into place, and then, drilling as close to the legs of the fork as possible, bore two more 3/32-in. holes to take the forward legs of B and D. After they are in place, a drop of solder can be used to join the two, the surplus being filed down smooth and rounded between the struts.

The exhaust stacks for the wing motors are made from 1/8-in. brass rod, 1 3/4 in. long. The rear end is hammered down in a tapering wedge, 3/8 in. long, 1/16 in. thick at the end. The forward end is hollowed with a file to fit snugly against the exhaust ring. Solder in place and solder the stack to the rear vertical strut, B. Complete the struts for the other wing engine, remembering to bend them in the opposite direction, and add the exhaust stack.

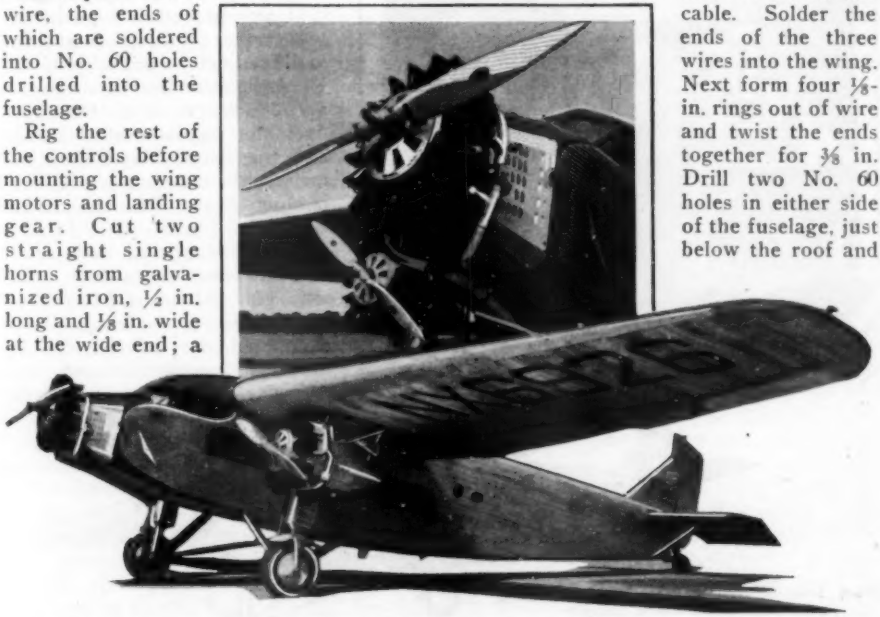
Engines and nacelles are then ready for painting. The cylinders, the rear end of the nacelle, the point of the wedge-shaped exhaust stack and the shutter openings on the nacelle nose are black. The woodwork, struts and exhaust pipe are painted with aluminum paint, or, as previously explained, may be nickelplated. If aluminum paint is used, do not paint

the strut shanks, as they are to be soldered to the wing. The painted shutter has nine openings, the sides of which are located by drawing lines down from the push rods on the cylinders. The outer edge of the shutter is marked by a circle 1/16 in. from the edge of the nacelle, and the inner edge by a 5/32-in. circle. Inside this, the center of the nacelle has a 3/16-in. black circle, to represent the shaft hole through the cowling.

Now locate the positions and attach the cylinders of the nose engine, centering the top cylinder. As the exhaust stack for the nose motor is located beneath the fuselage, the ring starts with the top cylinder and ends with the one on its left; otherwise all details are the same as for the wing engines. The exhaust stack is made from 1/8-in. brass rod, 2 1/4 in. long. Instead of flattening one end, it is bent, as shown in the photographs. The forward end is hollowed and soldered to the ring between the two bottom cylinders. Halfway along its length, a dot of solder holds it away 1/8 in., and the end, just forward of the curve, is supported in a loop of tinned wire, the ends of which are soldered into No. 60 holes drilled into the fuselage.

Rig the rest of the controls before mounting the wing motors and landing gear. Cut two straight single horns from galvanized iron, 1/2 in. long and 1/8 in. wide at the wide end; a 1/16-in. hole is drilled in the wide end and a No. 60 hole in the other. These are for the rudder controls. Drill a 1/16-in. hole in the nose on either side at the rear edge of the nose cowling, insert a short length of 1/16-in. wire, solder in place and solder the horn on the end, pointing the latter backward and down at an angle of 45°. The control cables from this and the ends of the flipper horn, already in place on the end of the control-stick rod, lead up to the wing at a point 1/4 in. back of the front edge of the second cabin window. Drill two No. 60 holes into the bottom of the wing, as close to the fuselage as possible, placing the second hole 1/8 in. to the rear of the first. A third hole is drilled 1/8 in. out from the front hole. Solder the end of a length of tinned wire into each hole, lead the two nearest the fuselage through the ends of the flipper horn, draw them tight and solder; solder the third through the rudder horn.

The cables from the wing to the tail surfaces lead into the wing 1/4 in. from the trailing edge, three holes being drilled in the same manner as before, the outer hole for the rudder cable. Solder the ends of the three wires into the wing. Next form four 1/8-in. rings out of wire and twist the ends together for 3/8 in. Drill two No. 60 holes in either side of the fuselage, just below the roof and



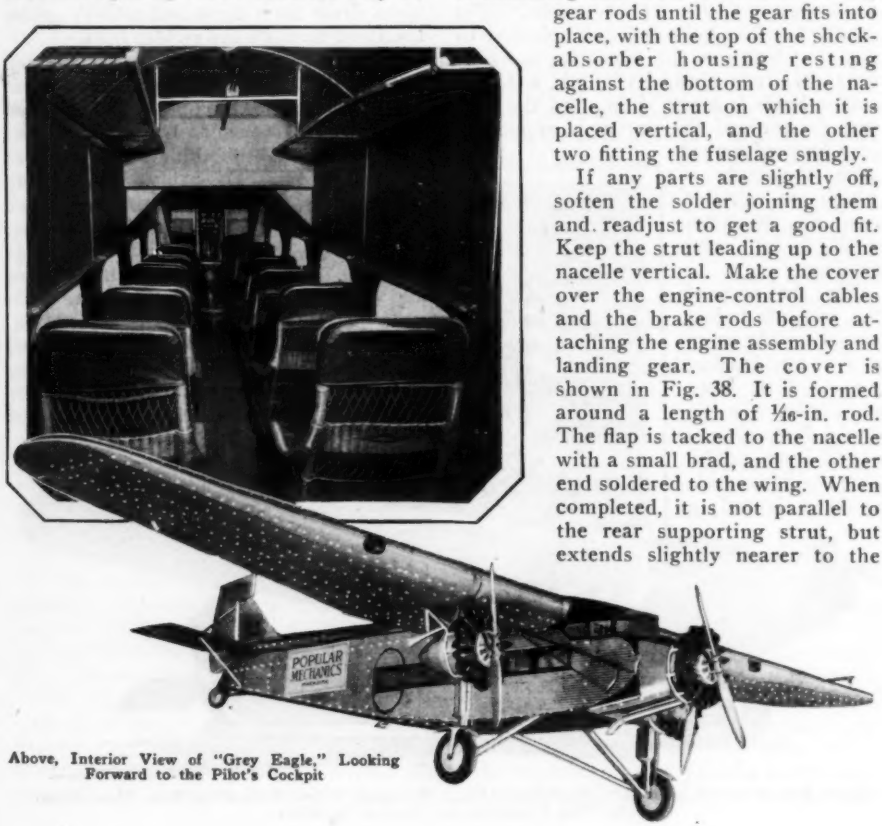
Above, Nose of the "Grey Eagle," a Northwest Airways Transport; Below, View of the Same Plane, Showing Wing Numbering and Name on Stabilizer

1 in. to the rear of the last cabin window, placing one hole on each side 3/16 in. below the other. Solder the shanks of the ring to the fuselage and pass the top flipper control through the top ring and the lower flipper and rudder cables through the lower one, draw the wires tight through the holes drilled in the horns, solder and cut off the ends.

The lavatory window, on the left side of the fuselage comes next. The center of the small round deadlight is 3/4 in. aft of the rear edge of the window and 5/16 in. above the window's top line. Drill a 1/8-in. hole a short distance into the wood, then, using a 5/16-in. wood bit (not a metal drill), carefully ream out the metal to that diameter, and drill a short distance into the wood beneath. Paint the hole black, cut a 5/16-in. disk of celluloid and glue it over the opening. The celluloid may be sprung in under the metal to look better.

To mount the wing engines and landing gear, drill a 3/32-in. hole in the wing on a line with the front row of rivets on the underside, centering it in the first corrugation inside of the strip of smooth metal which passes around the wing. Place the front wing-engine strut in this hole, and mark the position of the rear strut, in the same corrugation. Drill out the hole, then mark and drill for the third strut. Force the supports into place until the vee of the struts is close against the wing. Slip the landing gear into the hole in the bottom of the nacelle and mark the position for the holes by which the diagonal struts will be attached to the fuselage, keeping the forward strut at right angles to the body. Drill the two holes, the rear one at an angle. Cut off excess streamlining and the ends of the landing gear rods until the gear fits into place, with the top of the shock-absorber housing resting against the bottom of the nacelle, the strut on which it is placed vertical, and the other two fitting the fuselage snugly.

If any parts are slightly off, soften the solder joining them and readjust to get a good fit. Keep the strut leading up to the nacelle vertical. Make the cover over the engine-control cables and the brake rods before attaching the engine assembly and landing gear. The cover is shown in Fig. 38. It is formed around a length of 1/16-in. rod. The flap is tacked to the nacelle with a small brad, and the other end soldered to the wing. When completed, it is not parallel to the rear supporting strut, but extends slightly nearer to the



Above, Interior View of "Grey Eagle," Looking Forward to the Pilot's Cockpit

fuselage. Remember left and right flaps are needed.

The brake rod on each wheel is a length of 1/16-in. rod. Hold it against the front of the shock-absorber housing, with the end resting on the nacelle, mark the position of the end of the nacelle, drill a 1/16-in. hole halfway through the nacelle, and slip the rod into it. Mark the rod on a line with the axle, and cut it 1/8 in. longer than required. Bend the extra 1/8 in. at right angles, so the end will press against the wheel, and secure the rod with a drop of solder to the mudguard. The end then appears to enter the wheel. Attach the three propellers with round-head nickeled escutcheon pins, and the engines are complete.

Side View of Model, Showing Position of Insigne

To make the navigation lights, cut three pieces of the plain uncorrugated metal to the size shown in Fig. 39. Each light is formed of one of these pieces as a center for two drops of solder, and is secured to the plane by the small projecting tee. Drill 1/16-in. holes in the wing tips at the point of greatest length of the wing, and a third in the top of the rudder 1/8 in. from the leading edge. Solder the small flat pieces in place, the wing lights parallel to the wing, and the tail light vertical and in the plane of the rudder. Then, taking a big drop of solder on the iron, drop it onto the light, and the shape of the metal center, plus surface tension, will mold the drop into one-half of the streamline form. Turn the ship over and drop another drop on the other side. The plane should be tilted with the light pointing slightly downward during the process to keep the solder from spreading to the wing, and may be tilted slightly forward to make the drop fill out the form.

The landing lights, one on each wing, are cut from 1/4-in. dowel stock, as in Fig. 40. Instead of pointing straight ahead, they point slightly out, to illuminate a broader path. The rear of each light is hollowed to fit the leading edge, the cut being made 1/16 in. deeper on one side to point the light outward. A small bead is formed to represent the rim of the lens. The light is mounted 1 in. in from the inner end of the smooth metal at the tip, so that it points straight ahead with the tail down on the ground. The front of the light is black, then covered with celluloid attached with ambroid. The edges are painted the same as the ship's trim.

The step for the passenger cabin is made from wire approximately 1/32 in. thick, as shown in Fig. 40, and soldered in place beneath the cabin door. A pitot tube, the business end of the airspeed indicator, is made from the same size wire and soldered into a hole drilled in the leading edge of the left wing, directly in front of the aileron horn.

Painting completes your ship. I paint the Northwest Airways insigne on my models, the same as on the ship I fly. It occupies a circle 1 3/8 in. in diameter.

The cowling over the pilot's cockpit, the cockpit window frames, the narrow edge around the cabin door, the space between the cabin windows, and a 1/8-in. frame around the cabin windows should be painted. On the Northwest Airways Ford ship I fly, the color is maroon. We also paint the top quarter of the nose cowling to keep it from reflecting the sun's rays into the pilot's eyes, using the same color. The ship's identification numbers, as required by law, are painted on either side of the rudder, on the top of the right wing and underneath the left wing. The number of the ship I fly is C7739, the "C" standing for commercial. The wing numbers are 3/4 in. high and occupy a space 3 1/2 in. long, centered behind the landing lights, as shown in the photographs. The rudder numerals should be 1/4 in. high. The name on the vertical stabilizer consists of the word "Ford" in the familiar script, with the word "Tri-Motor" in block letters below it, the whole occupying a space 3/4 in. square. A reinforced space on top of the wing, used by the mechanics when fueling the ship, bears the words, "Walk Here," in black, inclosed in a box 3/4 by 4 1/2 in.

Extension for Operating Wall Hydrant

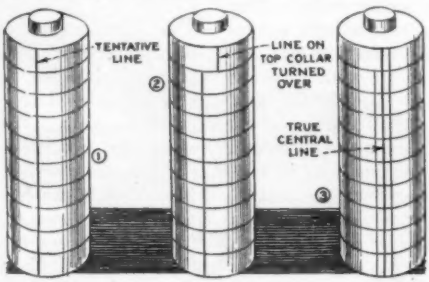
Shrubbery along the wall of our home made it very difficult to get at the hydrant,

Operating the Wall Hydrant through Dense Shrubbery Is Easy with This Extension

so I made the extension shown in the illustration. It consists of a stout pole with three wood screws partly driven into one end to engage with the hydrant handle. The other end of the pole is fitted with a short iron crossbar, and a support, with a V-notch at the upper end, is driven into the ground as indicated. The handle is just visible, and is easily accessible.—Hi Sibley, Pasadena, Calif.

Simple Method of Dividing Collars

A timesaving method of dividing collars as compared with the usual procedure of marking one or two collars at a time with a surface gauge while holding them in a V-block, is indicated in the drawing. The collars are stacked on top of each other over a rod. A square is then brought up against the sides and lines are scribed from top to bottom diametrically opposite each other, using the eye alone as a guide. The collars now appear as shown in stack 1. Turn the top collar to the position shown in stack 2, matching one of its lines to the others in the stack. The line on the opposite side will then be found offset about as shown. Scribe a second line down from the mark on the top washer on this side of the pile. Divide the distance between the two lines and scribe a new center line.

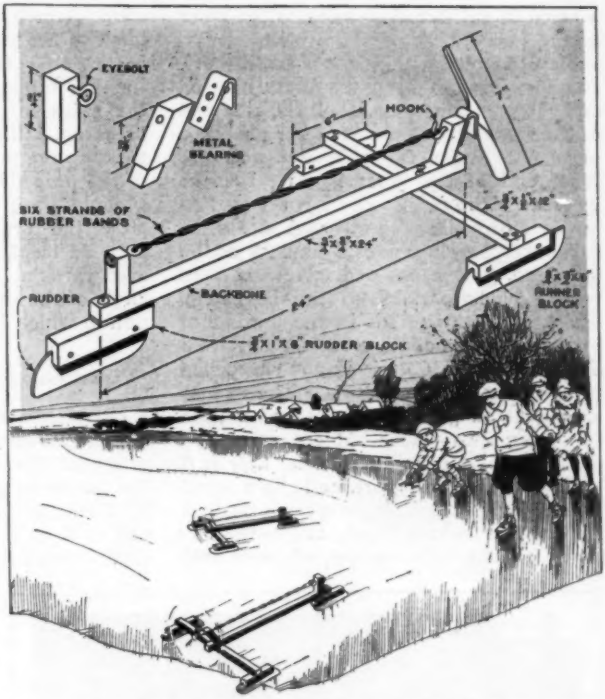


Simple Method of Marking Collars with Two Lines an Equal Distance Apart

Sewing-Machine Troubles

Sewing-machine troubles are usually very small and when one knows how to locate them, the remedy is simple enough. The most common troubles are skipped or missed stitches, breaking of the thread, uneven tension; and rough needles. Stitches are missed when the needle thread forms a loop as the needle reaches its lowest point, and the point of the hook or shuttle does not enter the loop. Bent needles are the common cause of missed stitches, as the loop is formed too far away from the shuttle point. Skipped stitches may also be caused by using too small thread or too large a needle. After determining the thread to be used, choose a needle that has an eye just large enough for the thread to pass through freely. Thread breaking is caused by too much tension or by using a rough needle. The hole through which the thread passes and other parts of the needle can be made quite smooth with emery cord or cloth. If the thread still breaks, see whether the tension is right and examine the needle very closely. The long groove is often made rough by the end of the shuttle touching it, and a needle in such condition should be replaced with a new one. A correct lock stitch is one where the top and bottom threads lock in the middle of the thickness of the material. If the bottom thread shows on top of the material, increase the bottom-thread tension or decrease the top-thread tension. When the top thread is seen on the underside of the material increase the top-thread tension or decrease the bottom-thread tension. It often hap-

pens when hard or rough material is sewed that the needle point becomes rough or turned up, which results in breaking the bottom thread, skipped stitches, large holes in the material and poor or irregular feeding of the work. This can often be remedied by replacing the needle or making the point smooth. If, after these corrections have been made, the machine won't sew, see that it runs on time. This is done as follows: Tip the machine back and turn the wheel by hand slowly, watch the needle get to its lowest point and ascend ⅛ in.; the shuttle point should now be just above the needle eye. This is the correct timing. If adjustments are necessary, raise or lower the needle bar by loosening the screw holding it in position and tighten it again after the correct adjustment has been made.—J. D. Calvert, Preston, Can.



You Can Have Great Sport with an Air-Propelled Model Ice Plane, and the Cost of Building It Is Very Small

Substitute for Glass Coffeepot Top

When the glass top of the coffeepot is broken and it is desired to make coffee before it is possible to purchase a new part, get a small cream bottle of the kind shown in the illustration and insert this in the lid as indicated. Such a bottle will be readily accommodated in most coffeepot lids.—Mrs. Ella Besocke, Chicago, Ill.

Hard oil should be used with thread dies.

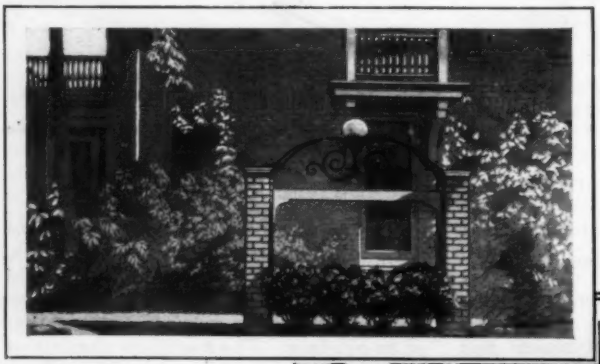
Air-Propelled Model Ice Scooter

Anyone who has built a model airplane or who is interested in this recreation, will find nearly as much enjoyment in building an air-propelled model ice plane, and the cost will be much lower than that of an airplane. The backbone consists of a single stick of white pine, 24 in. long and ¾ in. square. At each end a small block is attached to which the rubber motor is fastened. The rear block is vertical and projects from an opening in that end of the backbone. The other block is pitched forward so that the propeller will clear the front end. The height of the blocks should be about 2¼ in. above the backbone. The propeller is 7 in. long and can be carved from any lightweight soft wood, such as white pine, whitewood or even clear spruce. Cut it to general model-airplane proportions and then drive a piece of bicycle-spoke wire through the exact center for a shaft. The bearing is

a piece of stiff brass screwed to the front of the forward support and bent over as shown. A hole for the shaft is drilled horizontally through both the brass bearing and the rear support. Hook the rear end of the shaft over as shown, after placing a washer between the propeller and the front end of the brass bearing to take up wear. The runner plank is a 1 by 1½-in. piece of white pine fastened across the backbone at right angles, 2 in. back of the bow end. At each end, screw a 1-in. square block parallel to the backbone. Make a lengthwise slit in the bottom of each to accommodate a runner cut from light sheet steel, 6 in. long and sharpened to a V-edge on the bottom. The runner should fit snugly in the slot and should be driven into place. At the stern end of the backbone, drill a vertical hole just back of the rear support, and slip a small bolt through the hole to permit fastening another runner block, the bolt serving as a pivot. The rudder, which is held by this block, is made of the same material as the runners and is cut to the same shape. The pivot bolt should have a lock washer between the block and the backbone, so that the rudder will turn stiffly. Varnish or oil should be applied to all the wood to protect it against moisture. The motor consists of six strands of ⅛-in. rubber band. A 12-ft. length will be found sufficient. Attach one end of the bundle to the hook in the propeller shaft and the other end to an eyebolt provided at the top of the rear support. The bands should stand the strain of 250 or 300 turns without breaking. Choose a field of smooth ice, wind up the motor in a direction opposite to the propeller thrust, and give the boat a slight push at the same time you release the propeller. If properly built, such an iceplane will travel several hundred yards at a high rate of speed. The angle of the rudder will control the direction in which the scooter travels.

Visualizing Proposed Change in House

Let your camera aid you in visualizing any proposed changes about the house or grounds. Take a photo of that part of the house or grounds where the change is to be made and make two prints. On one of them sketch in the change you are considering and be careful to draw the details the same relative size as the photo. Then you will have before you two photos showing the grounds before and after the change, which can be placed side by side for comparison, and you can decide whether or not it will really prove satisfactory.—C. L. Meller, Minneapolis, Minn.



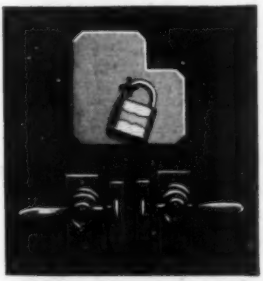
Before Making Changes in Your House or Grounds, Take a Picture and Make Two Prints; Then Sketch In the Proposed Change on One of Them

Renewing Blown Cylinder-Head Gaskets

Before putting in a new cylinder-head gasket, let it soak in water for an hour. This will expand the asbestos and make the gasket soft, so that it will fit into every irregularity of the metal when the cylinder head is drawn down. The gasket then becomes securely anchored in the irregularities instead of bridging over them, and the resulting tight fit prevents combustion gases from working under the gasket and burning it out. One precaution is necessary, however, and that is to tighten the nuts again after the engine has cooled down after its first run.—C. E. Packer, Chicago.

A Selective Icebox Lock

Where the family icebox is placed on the back porch, it is advisable to safeguard the contents by providing a padlock. In one case where the icebox had four doors, all of them except the ice compartment were locked by using one padlock and a sheet steel plate as shown. The latter is about 6 in. square and has two slots forming a cross in the center, which are large enough to be slipped over a staple attached to the icebox. One corner is cut out to leave the ice compartment accessible to the iceman, and by turning the plate one half or quarter turn, any one door can be opened while the rest are kept closed. If desired, a second plate, similar to the first but with all corners whole, can be used to lock all the doors. —Elton Sterrett, Savannah, Ga.



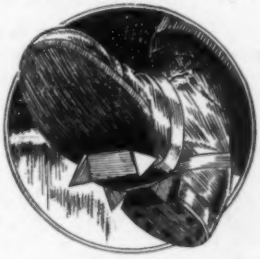
Removing Dents from Silverware

The drawing shows a method of removing dents from silverware that has been found easy and effective. All the material necessary is a piece of wood to form a paddle as indicated. It is made of maple or other close-grained hardwood. The narrow end is rounded and the surface carefully sanded smooth, while the flat end is screwed to the top of a bench or clamped in a vise. In use, the piece of silverware is grasped in both hands, slipped over the rounded portion of the paddle and the dent can then be pressed or hammered out with a suitable mallet. —Harry E. Gifford, Medford, Mass.

Maple Paddle with Smoothly Rounded Handle Used to Remove Dents from Silverware

Easily Made Ice Creepers

An ice creeper that can be made quickly at practically no expense is shown in the drawing. It consists of a metal plate, 1½ or 2 in. square, with the corners bent at right angles to form teeth. In use, it is placed in the arch of the shoe and held in place by means of heavy rubber bands cut from an old inner tube. The sheet metal used for the purpose should, of course, be heavy enough to dig into the ice without bending.—Glen F. Stillwell, South Haven, Mich.



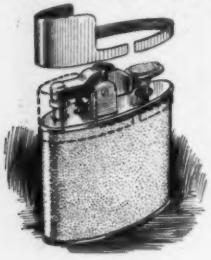
Portable Ironing Board of Small Size Is Held Securely on Any Table

Portable Ironing Board Saves Space

For those who desire a small, compact ironing board that can be attached to any table and stored in a trunk or suitcase, the one shown in the drawing is hard to beat. It consists of a piece of ⅜-in. plywood having two small blocks hinged to the underside, and is equipped with a hook at the end, which is slipped over the table edge.—Durfe Rockwell, Hollywood, California.

Windshield for the Cigar Lighter

A cigar lighter often is blown out when used outdoors, but this trouble can be overcome by fitting it with a shield as shown in the drawing. It consists of a piece of fairly light sheet brass or tin, cut and bent to fit over the top of the lighter. It is best to use metal that is slightly springy so that the shield will stay in place. The wide portion incloses the flame and prevents it from blowing out. —Myron L. Harmon, South Bend, Ind.

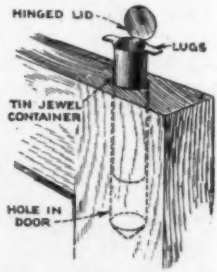


Aluminum Is Best Metal for Lining of Window Sills

A piece of 30-gauge sheet aluminum, screwed to the top of the kitchen-window sill, makes a good shelf for pots and pans when the contents need cooling. Tin and galvanized sheet iron have been tried, but these metals soon become dirty and stained and zinc is too soft, but aluminum has been found satisfactory and is easily kept clean. Besides its use in the kitchen, such an aluminum plate is an ideal lining when flowerpots are set on the sills.

Secret Hiding Place for Jewels

For hiding jewelry in a comparatively safe place, which can be provided without the necessity of calling in the help of any outside workman, get a brace and a 1-in. bit, and bore a hole in the top of a door, as shown in the drawing. Then make a sheet-metal tube to serve as a container. The bottom of the tube is closed by a disk soldered on, and small lugs at the top are bent outward to prevent the container from dropping into the hole too far. If desired, a hinged lid can be fitted on the tube or a cork inserted in the open end, taking care, of course, that it does not project far enough above the door to interfere with opening and closing it, and above all, that it is not noticeable.



Removing Ink Stains from Rug

Make a paste of starch and buttermilk, and spread it over the ink spot on the rug. Let it remain there until dry and then rub off. No trace of the ink will be left. Of course, this remedy only applies to ink spots that are still wet. The remover should therefore be used immediately.

SHOP NOTES

Blower Cuts Down Fuel Cost

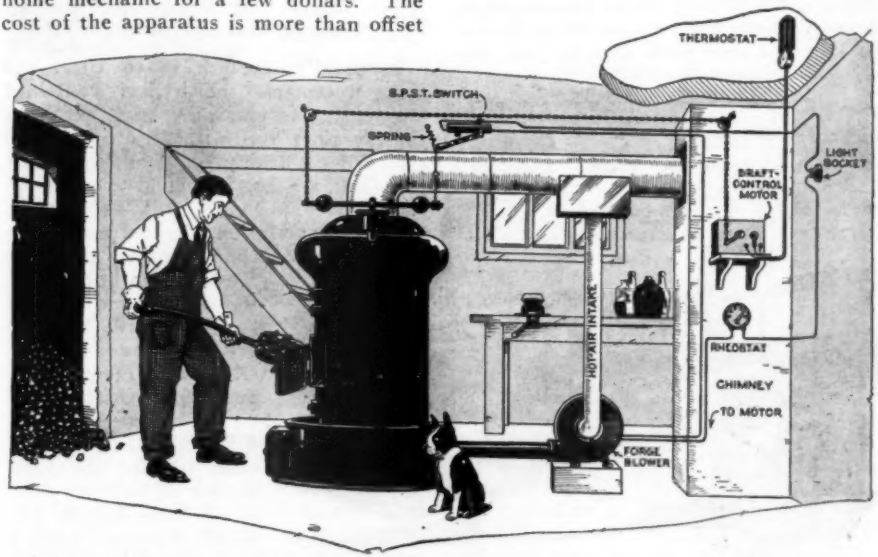
By BARRY A. ROSS

TO THE owner of a small home who is interested in a large saving in heating his home every year, I believe the following outfit which I have rigged up in my home and have used for two years, will be of interest. I have saved about $50 a year in the cost of my coal since I started using this device. In place of stove or nut coal at $16 a ton, I am now heating my home with the same amount of fuel, using buckwheat coal at $9 a ton, thereby saving $7 on every ton of coal burned.

The attached diagram shows the arrangement of the various parts, which can be hooked up and installed by any home mechanic for a few dollars. The cost of the apparatus is more than offset by the saving in coal. I purchased a secondhand thermostat with control box for $20, and the forge blower which is used cost me $3. The rest of the apparatus was made in my own workshop.

The forge blower is hooked into the draft plate on the ash pit of the furnace. It is not necessary to use the hot-air intake shown, but I believe that this is an added advantage, as the fire is then fed with hot air, which is drawn in around the stack before it enters the chimney.

The thermostat and its control motor are hooked up according to the directions which accompany it. Then the front arm



This Simple Arrangement Saves Mr. Ross from Fifty to Sixty Dollars a Year on His Coal Bill, by Burning Buckwheat Coal Instead of More Expensive Grades

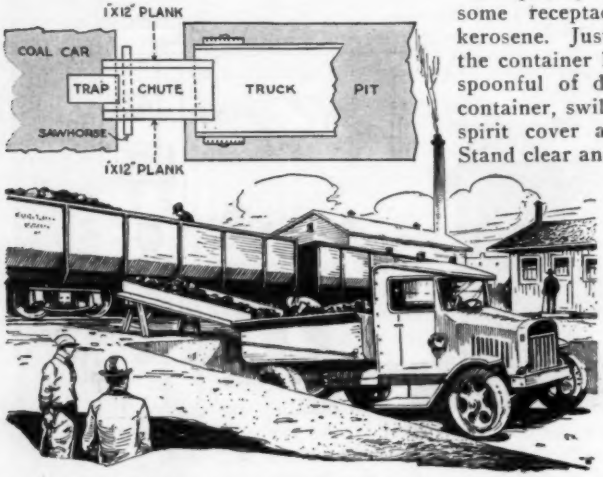
of the regulator valve is connected to the arm of the control motor, so that the draft will be opened and closed by the action of the thermostat. The back end of the furnace-regulator arm is attached to the handle of a switch by a threaded eyebolt, which is set so that it will automatically open the switch at any desired steam pressure, independent of the thermostat control. This adjustment will necessarily have to be determined by experience after the furnace is in operation. The end of the switch handle is also held in a closed position by a light spring, as shown in the drawing.

The switch referred to is a single-pole single-throw switch, attached to the ceiling over the furnace so that the handle of the arm is directly over the back end of the furnace-regulating arm, and connected in one side of the line from the electric-light socket which drives the motor of the blower. The other side of the light line runs through a rheostat which controls the speed of the blower motor. As soon as the regulator arm opens the draft, the blower goes on, and when the draft is closed the blower stops. This arrangement, of course, may be altered to suit the type of furnace which is in the home. The thermostat control box can be run from batteries, or connected with a bell transformer using the terminals.

Any home mechanic can, with a little labor, install this outfit and save more than its cost in the first year. I am burning No. 1 buckwheat, and can get up 5 lb. of steam in about five minutes with this arrangement. It has not been necessary to change the furnace grate.

Chute and Pit for Unloading Coal from Drop-Bottom Cars

Nearly all coal cars now have drop bottoms for side delivery, but in many small towns and even large yards in cities there often are no modern silos and unloading devices. A simple substitute arrangement, consisting of a suitable steel chute and a sloping pit to accommodate delivery trucks, can be provided as shown, so that the coal runs directly into the trucks. Besides saving time in unloading, this method also involves less breakage of coal than when it is thrown over the side of an open car. The chute is made of heavy steel and is supported by two stout wooden horses. It is, of course, advisable to provide strong, reinforced concrete walls and floor for the pit, to withstand the weight of the trucks.



Steel Chute Delivers Coal from Drop-Bottom Cars to Truck Located in Pit Alongside of Tracks

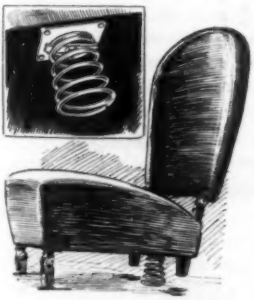
Cleaning Out Kerosene Cans

Frequently one wishes to clean out some receptacle which has contained kerosene. Just empty out whatever dregs the container has in it, and drop a tablespoonful of denatured alcohol into the container, swilling it around to make the spirit cover as much area as possible. Stand clear and drop a lighted match into the container, and after the spirit has burned out, it will be found that the receptacle will be quite free of kerosene.—V. Clapham, Pietermaritzburg, South Africa.

¶Setscrews can be tightened without the usual danger of twisting them off if the heads are lightly tapped with a hammer while drawing them tight with a wrench.

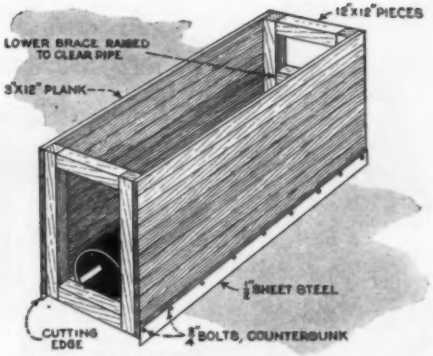
Shock Absorbers for Auto Seats

Shock-absorbing coil springs for the front seats of two-door sedans have been placed on the market. They consist of heavy coil springs, four to a set, one being slipped over each seat leg. It is frequently found, however, that this arrangement raises the seat too high, or that the springs are too stiff to produce the desired action, especially if the occupant is of light weight. A simple remedy consists in using only one spring under each seat instead of two. It can be fastened either to the floor or to the underside of the seat, as desired, in the center near the rear edge. To attach them, proceed as follows: Cut a square piece of heavy sheet iron, large enough to support the spring; round the edges, drill a small hole at each corner for woodscrews to hold the plate in place, and drill a large hole in the exact center to receive a stovebolt. Get a strip of fairly heavy iron or brass, cut it about ¼ in. longer than the diameter of the spring at the end where it is to be attached, and drill a hole in the center for the stovebolt. The end coil of the spring is clamped between the strip and the plate, the stovebolt being used to hold the assembly tightly together. Another metal plate may be provided to serve as a bumper for the other end of the spring. Springs arranged in this way have been found to improve the riding quality of the seats considerably.—Walter E. Burton, Akron, Ohio.



Trench Box Speeds Up Pipe Laying

A western contractor has found that the use of built-up trench boxes, open at the ends, top and bottom, as shown in the drawing, speeds up pipe laying in wet or mucky soil. A shallow trench is first excavated by dragline or steam shovel and the box is then placed in the trench to facilitate the remaining excavation by hand. The sides of the box are provided with steel cutting edges at the bottom, and its weight forces it down as fast as the earth is removed. This method is adapted to practically all sizes of pipe, when laid in trenches not more than 10 or 12 ft. deep. It saves the expense and time required for driving sheet piles and installing crossbraces. The boxes must be substantially made of suitable plank. They can readily be moved about by means of the dragline or steam shovel and can be used over and over again.—Ivan E. Houk, Denver, Colo.



Substantially Made Trench Boxes Save Time and Labor in Excavating Trenches for Pipes

Crosspiece on Stepladder Protects Windows

For use around windows and greenhouses, a stepladder, provided with a crosspiece at the top, as shown in the illustration, will be found a convenience as well as a protection for the window. It consists of a length of angle iron or stout piece of hardwood bolted to the top step. The piece straddles the window so that the ladder will not slip against it.

Simple Arrangement for Automatically Supplying Water to the Stock Tank

Self-Filling Stock Tank

For filling the farm stock tank automatically, the arrangement shown in the drawing has been found effective and durable. The tank is mounted on a platform bolted to a pair of wagon springs, which are in turn bolted to a couple of planks or other suitable base of 2-in. material. A wooden connecting rod is pivoted to the faucet handle of the water supply and to the platform on which the tank stands. When the tank is full, the weight of the water compresses the springs, allowing the tank to sink several inches, and when it is empty the springs force the tank up again. This vertical movement closes and opens the faucet and, once adjusted, makes further attention unnecessary.

Holder Simplifies Grinding Reamer Shank

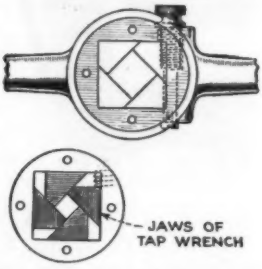
In making a large quantity of reamers, having the firm's name stamped on the shank, it was necessary to file off the burr after the stamping. The filing was done while the work was revolving, but the results were unsatisfactory, as this operation tended to get the shanks out of round. To eliminate the trouble, the illustrated holder was made, which allowed the reamers to revolve while they were held against a disk grinder. The burr was removed without touching the rest of the shank, and the surface was then polished on a buffing wheel while the work was still in the holder. The work can be held firmly or allowed to revolve at will.—W. L. Miles, Providence, R. I.

Getting Tension Spring in Place

It is often rather difficult to get a tension spring back in position after it has been removed, but in many instances this can be done by tying a length of cord to the end of the spring and then pulling the spring into place.—A. G. Robinson, Cristobal, C. Z.

Novel Tap Wrench

The drawing shows a tap wrench having four movable jaws which can be adjusted to increase or decrease the size of the opening. The jaws are made to slide against each other diagonally and against the sides of the square opening in which they fit, so that movement of one jaw causes an equal and corresponding movement of all the others. To adjust the jaws and to hold them in any desired position, a hole for a thumbscrew is drilled and tapped partly into one jaw and partly into the adjacent portion of the frame, as indicated.



Easy Method of Lining Brake Bands

When a brake-relining machine is used, the lining usually is fastened by means of tubular rivets. Without such a machine, it is better to use split rivets and clinch

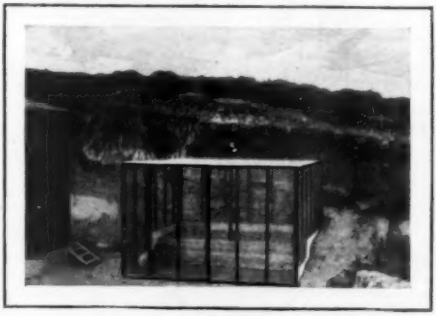
them into the lining. These rivets are rather awkward to handle, however, and it is hard to spread and clinch them single-handed. Old flywheels and transmission drums are often used to spread the rivets but they are not always satisfactory, because the rivet has a tendency to merely flatten out instead of spreading. The best thing I have found for the purpose is a spoke of an old auto wheel. This is fastened in a vise so that the end projects just a trifle above the vise jaws. The rivets are then driven into it. The shape and hardness of the wood make the rivets spread without the tendency to flatten on one side only. Clinching is done afterward with a hammer.—Glen F. Stillwell, South Haven, Mich.

Use of Emery Cloth in Reseating Valves

When using a valve-reseating tool on a hard spot in a cylinder valve port, it occasionally happens that the cutter will not take hold, especially in the case of the exhaust-valve port. To overcome this trouble and save the cutter, use a small piece of emery cloth under one side of the cutter. This will remove the glaze so that the cutter will take hold.—Edwin Schubach, Orofino, Idaho.

Wire-Screen Inclosures Protect Plants from Frost and Wind

Wire-screen inclosures are the most recent innovation in agricultural practice of some southern states. They are used for protecting plants from frost and wind and it is claimed that the interior is sometimes as much as 12° warmer than the exterior. The structures are arranged to point north and south, leaving their longer sides facing east and west in order to minimize obstruction to the sun's rays, and the narrow sides of the uprights are also set east and west. Wire screen of ⅛-in. mesh is used.



Fine-Mesh Wire-Screen Inclosures Keep Frost and Wind from Plants in Southern States

Commercial Artist Uses Roll of Paper on a Handy Holder for Sketching

Paper Roll for Sketching

Ordinary white wrapping paper, which can be obtained by the roll, will be found entirely satisfactory by the commercial artist for making preliminary sketches. It is mounted on a suitable board, as shown in the illustration, brackets for the roll being mounted at the upper end. Part of an old hacksaw blade is fastened across the bottom of the board and the paper is slipped under it, so that it can be torn off.

Blowing Chips Out of Oil Holes

After watching the oiler at a planing mill dig out the oil holes with a stick, I suggested that he blow them out with a tire pump. He spliced a length of tube to the pump hose so that he could reach all the holes. One or two vigorous strokes sufficed to blow the dirt out of any hole thoroughly, whereas digging it out was very slow.—Graham Stuckley, Alexandria, La.

The Jointer in the

Jointing by Machine

THE COMING of the smaller type of jointer, which can be hooked up and run from any ordinary light socket, bids fair to revolutionize methods of working employed in home shops and small carpenter shops. Once a man becomes acquainted with the machine, he finds that there is much more that can be accomplished on it than merely the making of joints. However, before we go into any special problems, we will first take up the matter of knife jointing and setting. The home worker will find it best to ship his jointer head to the maker of his machine, and allow him to grind and set the knives. Where this is not advisable, the following instructions will enable a workmanlike job to be done:

In getting knives in shape for any jointer, they must be of equal weight, so that running balance may be maintained. For this purpose, a pair of little balancing scales is the best thing to use, and the knives accurately checked one against another, grinding a little more from the heavier knife or knives until all have been reduced to equal weight. In grinding jointer knives, most of us must make a set-up at an ordinary grinder or wheel stand. Fig. 3 shows how this may be done. The guide strip may be a piece of hardwood, rabbeted out, or it may be a piece of angle iron dressed straight and smooth within. In any event, it must be perfectly straight and true, and must be fastened firmly so that it holds its relative position to the wheel. It should be about twice the length of the knife being ground, and the center of its length should be opposite the wheel. A little study will show that the degree of bevel on the knife will be governed by the distance the strip is set from the wheel. While woodworkers in general vary the bevel in working different woods to some slight extent, a good general rule is to make the length of bevel twice as great as the thickness of the knife. This will be found to give very satisfactory results. In grinding time after time, it will become necessary to set the guide so that grinding be-

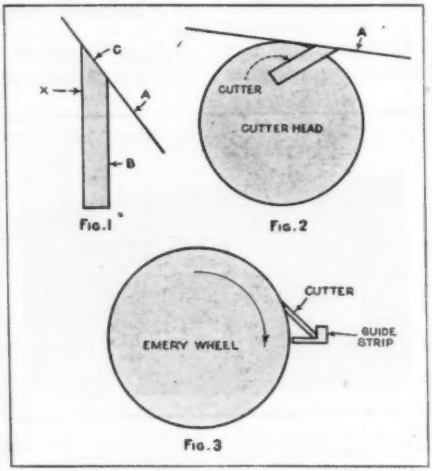


Fig. 1 Fig. 2 Fig. 3

Home Shop

by John P. Hodgson

Jointing by Hand

gins at the side of the knife farthest from the edge, for if set centrally, the bevel will be reduced somewhat by the time the grinding is done. The grinding must be done slowly as the knife approaches an edge, if ground dry, to prevent burning it. Those accustomed to grinding cutters for metal will need to remember that this edge is much thinner and more delicate and will therefore not stand so much pressure on the wheel. The corners of the knives will need to be carefully watched to avoid dubbing them off, particularly those corners at the front of the knives, for, unless sharp, square corners are preserved, it will not be possible to make a good clean rabbet with the jointer. To sum up: these knives must be ground to equality in weight; their bevel must be twice as long as their thickness; care must be used to avoid burning them by dipping them in water frequently, and you must watch the corners.

There are one or two other things essential in grinding, one of which is that knives must be kept parallel, and another is that their edges must be perfectly straight. Knives which are out of parallel may balance perfectly on the scales, and not balance at all on the run. The reason straight edges are necessary is too evident to need much comment, but the way in which they are made straight when using a set-up like Fig. 3 is by holding them against a straight-edge, preferably one of metal. Grinding is a job requiring much care and patience, and unless it is properly done you cannot possibly expect to do anything like good work on the jointer.

In considering the setting of jointer knives, first refer to Fig. 1. In this drawing, B represents the jointer knife. After the knives are ground, and before they are set, it is necessary to whet them to remove the wire edge left by the wheel. Knives are always slightly hollow-ground as a result of grinding, and this is fortunate, as it allows you to whet them with much less effort. A represents the face of the whetting stone, and shows its application to the knife; the stone is best used with a rotary motion, and occasionally it is rubbed across the face of the knife, or side X, in order to remove any wire edge. It must be held perfectly flat to the face when doing this.

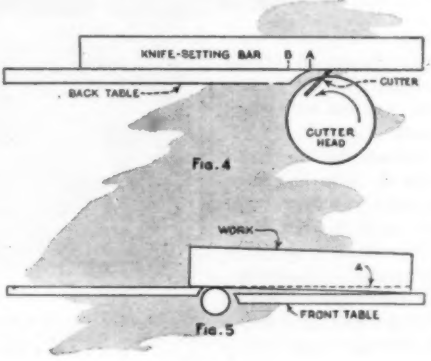


Fig. 4

Fig. 5

Fig. 2 shows an essential to be observed in setting the knives in the jointer head, and that is that the knife bevel has a certain relation to knife projection. The knives should always be held far enough back in set-

ting them so that, when the slip stone is laid across as shown at A, it will make contact both with the edge of the knife and with the head, and the edge will be whetted several times in the head before the stone starts removing anything from the back of the knife. Insufficient projection will result in dubbing off the knife edge in whetting, and too much projection will throw the back of the knife into contact with the stone, both of which must be carefully avoided. Set all knives approximately correct in this way, and then proceed as shown in Fig. 4.

Only one knife is shown in the head here, though there are never less than two, generally three, and sometimes four. All knives must be dealt with alike. The front jointer table is not shown, as it is not used in setting the knives. The knife-setting bar is made of some kind of hardwood, jointed perfectly straight and true. It is placed, as shown, on the back table, so that when the jointer head is revolved slowly backward as shown by the arrow, the knife edge barely contacts with the stick. The contact should be of such lightness that the stick will not move, which can be detected when the hand is laid on the mid-length of the bar. Moving the stick backward and forward across the bed or back table, gradually brings all the knives to that same perfect setting with the back bed. Never rush this part of the job, for on its accuracy good machine work is dependent. Once a perfect setting is obtained, the knives may be tightened securely in place, and the machine is ready. Another method of setting the knives is as follows: Drop the back table a little, so that the knives, when revolved forward (in the direction opposite to that shown by the arrow in Fig. 4) will catch in the knife-setting bar and carry it forward on the table a certain distance. Lay the bar on the table, with the front end pro-

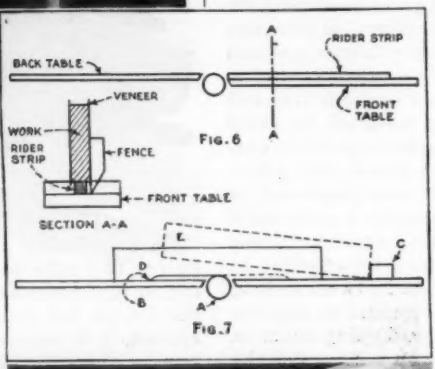
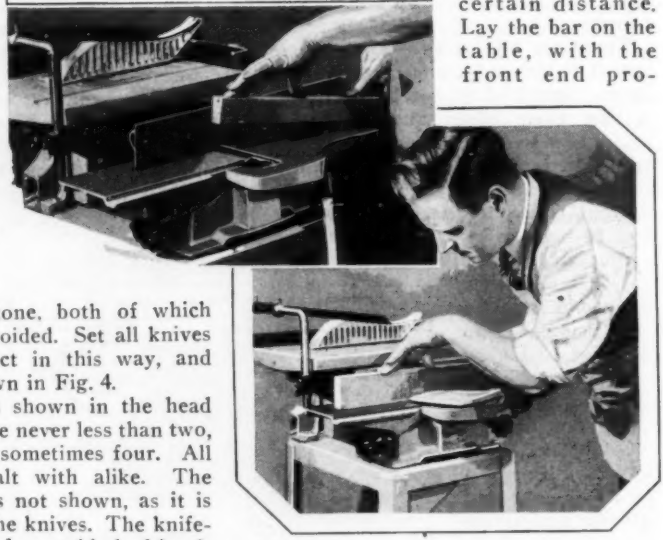


FIG. 6

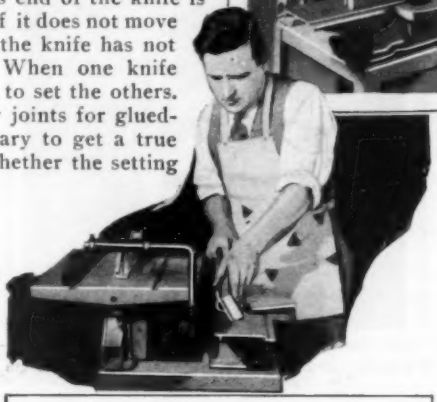
FIG. 7



Top, Setting the Knives to the Back Table; Center, Starting to Plane a Taper; Below, Checking the Back-Table Setting

jecting over the path of the knives, but with none of the knives in contact with it. Make a mark, A, on the bar, exactly at the edge of the back table. Now rotate the head so that the knife moves the bar forward, and make a second mark, B, on the bar, exactly at the edge of the table. Move the jointer head back, until the same knife is in the first position, move the bar back until mark A is again at the edge of the table, and the bar is at the opposite end of the knife. Then revolve the head forward again, and see if this end of the knife moves the bar forward the same distance. If it moves it farther, obviously this end of the knife is higher than the first; if it does not move it as far, this end of the knife has not enough projection. When one knife has been set, proceed to set the others.

In cutting ordinary joints for glued-up work, it is necessary to get a true edge. You can tell whether the setting of the back table is correct by the way the stock acts when being pushed across. Note particularly that the front bed of the jointer never has anything to do with this; the solution of trouble is always in the relative position of the head and the back table. That is why we set the knives from the back table. It sometimes happens, after the knives have been set, that the back bed is a little low, and this is best cured by running a stick out a little way across the head, then raising the back bed to contact lightly with it. It also sometimes happens that the back bed will get too high, and this results in crowding the piece up and away from the knives. When it is too low, the knives will snip the last end of the stock as it leaves the front bed. When jointing, be sure to apply pressure to the stock on the back table, just as soon as it is over the head.



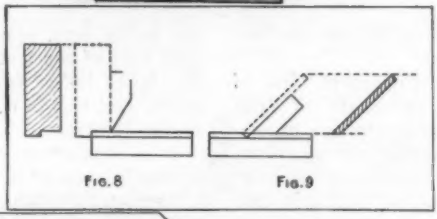
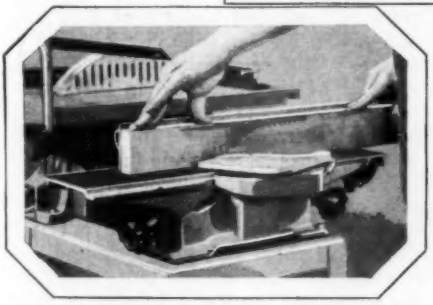


FIG. 8 FIG. 9

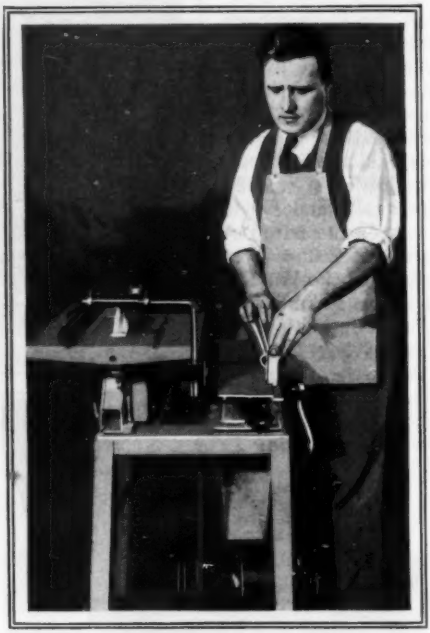


Top, Cutting Recess with Stop on Front Table; Center, Beveling Stock; Below, How Stock Is Held Down on Back Table

There are a few little tricks which can be practiced on the jointer, aside from its regular job. A great deal of tapering of different kinds can be done on the jointer, and one type of job is shown in Fig. 5. Notice that the first end of the piece is carefully laid over the head on the back table. Let the work down slowly and steadily, then push it forward as in any ordinary cut, and the knives will remove

everything that is below the dotted line A.

When veneering, the veneer, after gluing, usually overhangs the edges of the core stock. In such cases, the excess veneer can be trimmed flush on the jointer by using a rider strip. The front table is dropped down and a strip, such as that shown in Fig. 6, can be attached to it. The strip comes even with the top of the knife swing, in alinement with the back bed. The jointer fence is set up as shown in the section AA, and the veneer will be trimmed off clean and true with the core. Cuts can be gauged on plowed and rabbeted material in the same way, and, by the use of a curved rider and a correspondingly curved strip nailed onto a piece of material, curves can be successfully cut on the jointer.



Rabbeting on a Combination Jointer and Saw; Note How Rabbet Fits Ledge on Machine

Figure 7 illustrates a different kind of work, in which it is necessary to drop both tables. This is a hazardous proposition unless certain precautions are taken. A stop block must be fastened securely to the front jointer bed, as at C. This may be fastened by clamping or otherwise, but should be made secure in every case. The dotted lines at E indicate how the cut is first started. The back end is placed firmly against the back stop, and the piece is let down slowly and carefully on the knives as at D. Once the cut is started, and the piece moves forward, the danger is over. Danger is always present on woodworking machinery as long as solid wood lies directly behind the cutters, whether it be a saw or a knife machine. At B, where the piece is first let down on the knives, the cut will be perfectly smooth, as the knives are cutting with the grain. At A the cut is against the grain, and some tearing will occur, unless the cut is light, and the piece fed slowly. To overcome this, cut a little past the halfway mark, turn the piece end for end, drop in again from the other end, and run forward till the two cuts meet. In cases where the cut starts farther from one end than the other, it will be necessary to handle the material twice, and to reset the stop block after the first handling.

Rabbeting is one of the jobs that is handily done on the jointer, as shown in Fig. 8. The depth of the rabbet is controlled by the cut-out on the fence, or the depth of the rabbeting ledge, but the width is limited only by the length of the head. Small tenons are cut in the same way, simply by rabbeting on each side of the stock. Fig. 9 shows how the fence is set for beveling a piece of stock, and this is a very valuable feature of the jointer.

It is dangerous to joint short pieces on the jointer, so if this must be done, use a "pusher," which consists merely of a piece of hardwood about 6 or 8 in. long, and about 1½ in. wide for 2 in. of its length. The remaining length is 1 in. wide. The notch formed in this way is placed against the back of the work, and pushes it forward, while the longer portion rides on the work and holds it down.

Do not crowd the work, for, if this is done, the head is unable to clear itself of all the shavings made, and a certain number of them are carried around with it, getting in between the knife edges and the work, and causing a bruised or pitted appearance. So, on fine work, take light cuts and don't feed too fast.

Preventing Wood Rot in Porch Columns

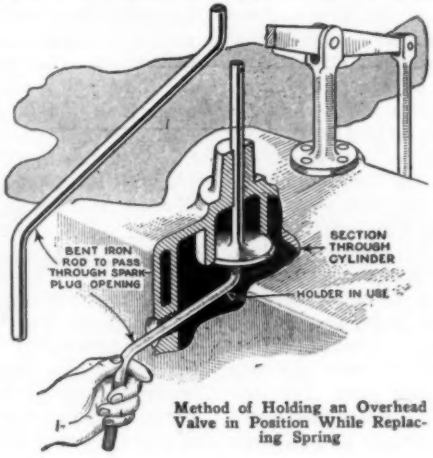
Wood rot in porch columns invariably occurs at the bottom where the moisture collects. The trouble can be successfully prevented by filling the bottom of the column with cement, which can be poured in from the top at the time the column is set up. It is, of course, also possible to follow the same method to fill portions of new columns which are used to replace the defective bottom portions of old ones, although this involves more or less difficulty and takes considerable time.—L. H. Georger, Buffalo, N. Y.

Washers Save Time in Fitting Bearings

When fitting connecting-rod bearings, considerable time is usually spent in running the cap nuts into place and tightening them, because a good bearing job nearly always requires a number of fittings before the correct adjustment is obtained. By inserting very thick washers as spacers on the cap bolts, the nuts can be run only a few threads, instead of all the way against the cap, thus saving time. —A. C. Wilson, Columbia Cross Roads, Pennsylvania.

Replacing Spring on Overhead Valve

When replacing a spring on an overhead valve in a motor of the type shown in the drawing, and it seems necessary to remove the engine block in order to hold the valve in position while the spring is being compressed, use the illustrated method, which will be found a great timesaver. A ⅜-in. iron bar is bent as indicated and inserted into the cylinder head through a spark-plug opening and is forced up against the valve while the spring is being slipped on.—G. A. Luers, Washington, D. C.

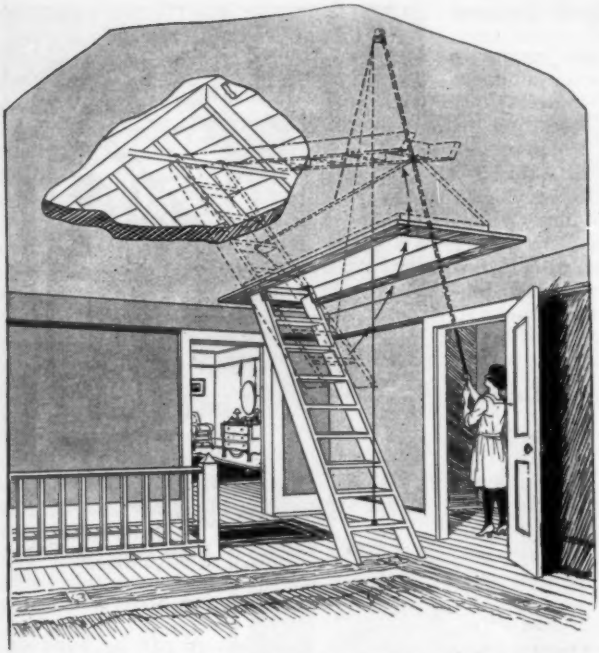


Method of Holding an Overhead Valve in Position While Replacing Spring

Use of Long Clothes Pole Makes It Easy to Hang a Carpet on the Line Single-Handed

A Carpet-Beating Short Cut

Carpets to be beaten can be hung on the line single-handed by following the method indicated in the illustration. Lay the carpet on the lawn with the pattern side down. Then fold it in half and run a clothes pole as near to the fold as possible, taking care that the ends of the pole project beyond the carpet. Lift one end of the pole up to the line and wrap the rope around it a few times. When doing this, the carpet should be held to prevent it from slipping down the pole. Follow the same procedure at the other end and the carpet will be hanging without sag. To remove it, uncoil the rope at one end and lower the pole until it rests on the ground and then do the same at the opposite end. —Ivie P. Holden, Chesterfield, England.



This Homemade Disappearing Stairway Is Handy and the Cost of Building It Was Only Three Dollars

Homemade Disappearing Stairway

When building a small house there was not enough space for an ordinary stairway from the second floor to the attic. On investigation we found that the cost of a ready-made disappearing stairway was about $75, but as we could not afford it at the time, we resorted to the use of a stepladder. The practice, however, of getting it from the garage, which was necessary quite frequently, was rather irksome, so we decided to make a ladder that could be hoisted into the attic by means of a rope and could be lowered in the same way. As the distance from the second floor to the attic floor was 8 ft. 7 in., the ladder was made 10 ft. long, lengths of 1¼ by 3-in. stock being used for the side rails, and narrow boards from old shipping boxes for the steps, these being spaced 12 in. apart center to center. Long stove bolts were used to draw the side rails together under each step. The ladder could be set at a convenient angle for climbing. At the upper end of each side rail a hook made of strap iron, about 1 in. wide and 3/16 in. thick, was attached. These were bent so that, when the ladder was standing in position for use, they engaged a length of 2 by 2-in. wood nailed to the attic floor close to the opening as shown. Two sash cords, each running through two pulleys fastened to the rafters in the attic at suitable points, and led through the attic floor into a closet on the second floor, served to raise or lower the ladder and the trapdoor, the latter being hinged at the side to facilitate closing the opening when the ladder was not in use. At the lower end of the rope holding the trapdoor a ring was provided and this was slipped over a hook on the wall of the closet in order to hold the door open. One end of the second rope is attached to the bottom step of the ladder, which enables one to hoist it into the attic, two positions of the hoisted ladder being shown by the dotted lines. From its position on the floor it is raised so that the hooks are slipped over a second 2 by 2-in. crossbar nailed to the attic rafters for holding the ladder. In this position the bottom of the ladder projects below the attic floor until it is pulled up still farther. The cost of the material needed for making this disappearing stairway was less than $3, which meant quite a saving.—N. G. Mellon, West Lafayette, Ind.

Wallpaper Protection behind Pictures

The condition of the paper on a wall behind pictures may be kept similar to that on the uncovered surfaces by placing a glass push pin in the wall where each lower corner of the frame rests. This keeps the picture away from the wall and allows the air to circulate freely.

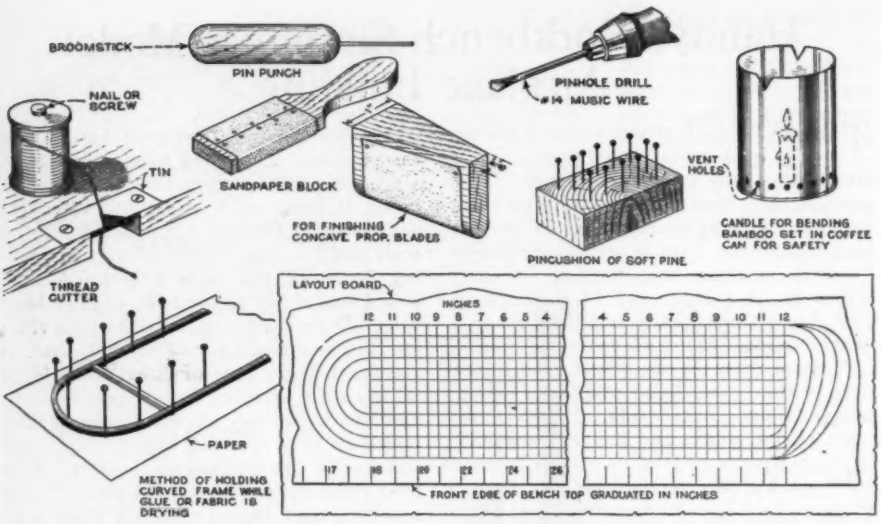
Handy Workbench Simplifies Model Airplane Building

THE AVERAGE model-airplane builder works in a chaos of shavings, wire, small parts, tools and odds and ends. If he mislays, for instance, a tiny prop-shaft bearing, he is liable to be up in the air longer than the Fort Worth plane before he finds it again, and tugging at what seems to be a loose end of thread may pull down some heavy tool on top of a delicate wing frame and upset the glue.

A spare room in my house was turned over to the young balsa craftsmen of our neighborhood, but inside of two days, table, chairs, trunks and shelves were piled so high with a confusion of things that work on a commercial plane was almost at a standstill. And when the boys couldn't find a 3-ft. fuselage in the mess, I thought it about time to step in and install a new system.

The workbench illustrated here is the result. There is nothing unusual about it; simply a place for everything, and everything is returned to its place after the day's work. Two redwood boards, 10 in. wide and 9 ft. long, were laid on two packing boxes of the same height. A 3-in. board was nailed to the back edge to keep things from falling off; at one end a shallow bin was made for hand tools and, at the other, four sizes of bolts, from ⅛ to ½ in., were screwed into a two-by-four, and the heads cut off for forms around which to bend the stiff music-wire loops and hooks. In the center, a chart, 24 in. long and 6 in. wide, was laid out in ½-in. squares, with inches marked each way from the center line. At one end are a number of semicircles and at the other several typical wing-tip curves. In laying out a wing frame, a piece of waxed paper is placed over the chart and the frame members are assembled over this, cemented and

While This Bench Appears Elaborate, Its Actual Cost Is But a Dollar or Two; the Neatness of the Layout, Combined with the Handy Wing Chart on the Bench Top, Make for Speed and Accuracy in Building


BROOMSTICK
PIN PUNCH
NAIL OR SCREW
TIN
SANDPAPER BLOCK
FOR FINISHING CONCAVE PROP. BLADES
PINHOLE DRILL
#14 MUSIC WIRE
VENT HOLES
CANDLE FOR BENDING BAMBOO SET IN COFFEE CAN FOR SAFETY
PINCUSHION OF SOFT PINE
THREAD CUTTER
LAYOUT BOARD
INCHES
12 11 10 9 8 7 6 5 4
4 5 6 7 8 9 10 11 12
PAPER
METHOD OF HOLDING CURVED FRAME WHILE GLUE OR FABRIC IS DRYING
FRONT EDGE OF BENCH TOP GRADUATED IN INCHES

Details of the Bench Accessories; Above Are a Number of Handy Tools, and Below Is Shown the Chart Laid Out on the Bench Top to Facilitate Assembling of Wings

held in position by steel pins until the cement hardens. The waxed paper prevents sticking to the bench top. In this manner frames can be laid out quickly and accurately. The front edge of the bench is graduated in inches to facilitate measuring frame sticks and other material.

Using a nail or long screw for a shaft, a spool of thread is secured to the bench and a strip of notched tin set over a recess in the edge of the bench for cutting the thread. The recess allows the tin to be set back so that it will not tear clothes. Since all model builders find the two hands provided by nature none too many, the thread-cutter is a decided convenience.

Tools, such as chisels, files, punches, etc., are kept handy in a block of wood with holes bored in it. Saws hang on the side of the boxes; brads for motor bearings, strips of brass and tin, and small parts, are kept in cigar boxes and do not get lost. By using a double boiler, heated by "canned heat," glue will thin out and is much more easily applied than when cold. This is especially important in gluing bamboo paper to delicate wing frames, etc., and makes a far neater job.

Cement is best applied with a flat or pointed stick. Brushes are not of much use, since ambroid and similar cements harden so quickly and there are few practical solvents. Keep a supply of sticks on hand and throw them away after they are used a few times. A small anvil comes in handy for flattening wire, brads, etc., and a small vise will serve many purposes. Both items can be purchased in hardware stores.

Shelves and racks in the packing boxes accommodate raw material and prevent the delicate sticks from being broken. I have found a tapered and rounded block, covered with sandpaper, indispensable for making the concave side of prop blades; sandpaper on a flat piece of wood also has many uses. The coffee-can holder for the candle makes for safety and convenience when bending the thin pieces of bamboo over the flame.

A workbench of this nature can be put up in two or three hours, including all the accessories, and it will easily save you many times that on every job. Besides, you can do far better work. Complete as the workbench appears, its cost is negligible.—Hi Sibley, Pasadena, Calif.

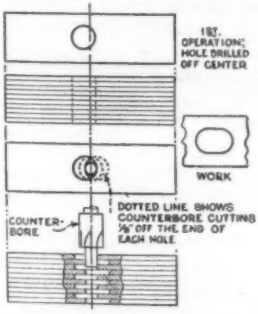
¶When scraping carbon from automobile pistons, and from the face of the cylinder block, use short headless setscrews to keep the particles of carbon out of the cylinder-head bolt holes. This method is easy and quick.

Kink for Model-A Ford Owners

Model-A Ford owners will appreciate knowing that when the water pump throws too much water out of the overflow pipe at high speed, which occasions a loss of water and causes the motor to overheat, the trouble can readily be overcome in the following way: Make a tin shim or gasket with a smaller opening than the one on the overflow pipe, and place it between the pump and the water connection at the top.—R. M. Shelton, Dallas, Tex.

Drilling Elongated Holes

Although a drillpress and a milling machine are usually required to drill elongated holes, I found a good method of doing this without any special tool. A batch of brass plates had to have holes drilled in the center, the holes being elongated ⅛ in., as shown in the drawing. I clamped ten of them together and drilled the hole off center the right amount to bring the finished hole in the exact center. After this the clamps were removed, the plates arranged with holes of adjacent plates off center in opposite directions, then clamped together again. Next I got a standard ½-in. counterbore with a ¼-in. pilot and ran it through the plates in the exact center. By this means a hole like that shown in the detail at the right was produced.—Harry Moore, Hamilton, Can.


1ST. OPERATION. HOLE DRILLED OFF CENTER
WORK
DOTTED LINE SHOWS COUNTERBORE CUTTING ⅛" OFF THE END OF EACH HOLE
COUNTER-BORE

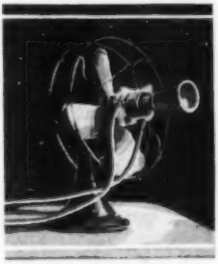
Device for Removing Humps from Auto Fenders

Humps in auto fenders are removed in a Denver radiator and fender shop by means of the illustrated tool. It consists of a 3-ft. piece of ¼ by 1½-in. steel bar, which is used as a lever. A leather pressure pad is looped over and bolted to an 8-in. length of the same-size bar, which is bent to form a loop as indicated, and is welded to the extreme end of the lever. Another 8-in. length of the same stock is bent to form a hook and is also doubled so that it can be slipped over the lever and adjusted to any size of fender. It has been found convenient to have a number of different-shaped pads for use with this device. The method of using it is clearly shown in the photo.—Jos. C. Coyle, Denver, Colo.

It Is Easy to Take the Humps Out of Fenders with This Improvised Tool

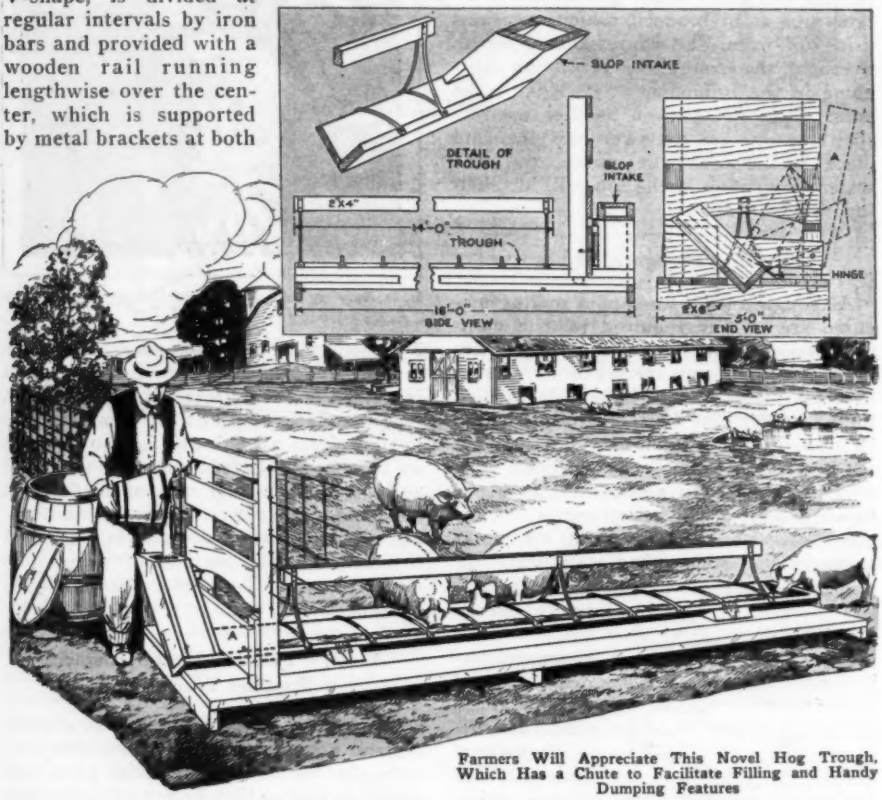
Electric Fan and Heater Element Supplies Warm Air

Combining the advantages of an electric fan and a heating element, a western photographer made the illustrated print and negative drier, which he found highly satisfactory. A porcelain screw socket was mounted on the frame of the fan as indicated to hold the heater element, and the terminals on the socket were connected to the electric cord of the fan so that both would operate simultaneously. The same idea can also be used to circulate warm air through a room, and for any other purpose where a warm draft is desired.—Carlton Groat, Portland, Oreg.



Improved Hog Trough

Here is a hog trough that has several features of interest. It has the regular V-shape, is divided at regular intervals by iron bars and provided with a wooden rail running lengthwise over the center, which is supported by metal brackets at both ends and the center. The novelty and utility of the trough consist in its hinged mounting, which permits easy dumping, and in the addition of a chute at the end, which serves the double purpose of conducting the slop into the trough and of a lever for dumping. It is, of course, necessary to provide a platform to which the trough can be conveniently hinged. The bottom board, A, of the fence is pivoted at one end so that it swings upward when the trough is emptied. A cleat near the top on the side of the chute nearest the fence, forces the board back into position when the chute is pulled back after dumping. The details of construction are clearly shown in the illustration and should be studied carefully before attempting to build one.—Luther Strosnider, Onaga, Kansas.



Farmers Will Appreciate This Novel Hog Trough, Which Has a Chute to Facilitate Filling and Handy Dumping Features

---

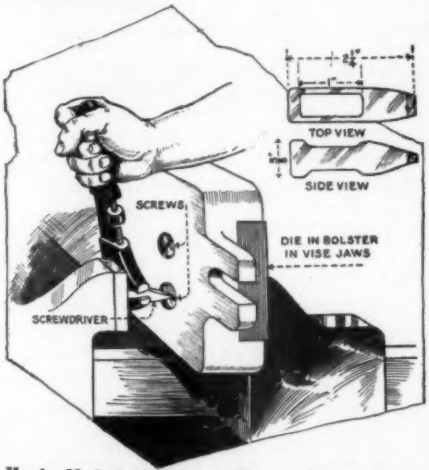
What to Do When Fords Boil

Everybody knows the usual causes of water boiling in the auto radiator, which include wrong timing, incorrect mixture, tight engine, wrong kind of oil, etc. However, an unusual condition, that has given trouble to many owners of new Ford cars, is the loss of water and the consequent boiling of the remainder when the car is driven for a long distance at a high rate of speed. A number of cars having this trouble were carefully checked and everything in connection with the engine and

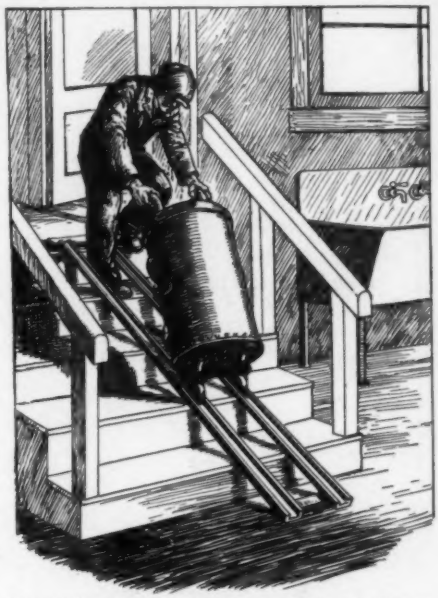
chassis seemed to be in good condition. In an effort to learn where the leakage occurred, the overflow pipe of the radiator was plugged up tightly. A road test was given and the water did not boil. Careful inspection then brought to light the fact that, on the cars having the top of the overflow pipe bent over toward the front of the filler neck, considerable water was lost when the motor was run at high speed, which was caused by the pump forcing it through the circulation system so fast that it was thrown into the overflow pipe until so much water was lost that circulation stopped. The remedy lies in bending the end of the overflow pipe toward the rear. Restricting the flow of water is not advisable.

Vise Used in Driving Screws

There are occasions when the mechanic has to loosen or tighten a screw with the aid of a large screwdriver and a wrench. Usually the screwdriver slips out of place when pressure is applied to the wrench. In cases where the work can be held in a vise, the illustrated method is highly convenient and the trouble is entirely eliminated. A short screwdriver shank is used. It is held in the slot of the screw firmly by bringing the vise jaw against it, making slipping impossible when the wrench is applied.—Henry Laraby, New Haven, Connecticut.



Handy Method of Using a Vise to Prevent Screwdriver from Slipping



Channel-Iron Track over Stairway Makes It Easy to Pull Up the Shop Truck

Track over Stairway Facilitates Moving of Shop Truck

When it is necessary to haul loads on hand trucks up a few steps, as is the case when adjoining floors in two buildings are not on the same level, the illustrated track will be found useful in that it saves considerable time and effort. It consists of two lengths of channel iron of sufficient width to accommodate the truck wheels. Both tracks are securely fastened to crosspieces to make a single unit, which can be set aside when not needed.—W. E. Trotter, Richmond Hill, Long Island, N. Y.

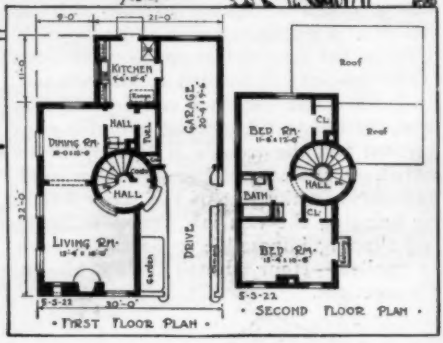
Old Files Are Made Serviceable by Acid Treatment

Files that have been worn until they are no longer fit for use may be made to render additional service by soaking them for 48 hours in a weak solution of sulphuric acid. The worn teeth are corroded so that numerous sharp cutting edges remain. When using sulphuric acid, it should be remembered that it is poisonous and corrosive, and, therefore, should be handled with great care.

COPYRIGHT POPULAR MECHANICS

PLAN NO. 5-S-22

A Style of the Hour is A House With a Tower



ARE you searching for something new in house styles? Do you want a picturesque little house brimful of decorative features along with a flexible plan and low cost? If so, this new design for a tower house should please you.

Old-world Spanish, Italian and Normandy features are here happily combined with all the practical demands by the modern American family. You can build the house on a thirty-foot lot. You can build it with or without a cellar. Without a basement, there's a saving of perhaps $400; may be more. You have a choice of materials. As shown, it is frame with stucco on metal lath. It will build well of solid masonry; common brick whitewashed, skintled brick or face-brick veneer.

Features are a circular stairway and a living room two steps below the level of the entrance hall. The fireplace has a raised hearth. A deep recessed window may be flanked with bookcases. An arched opening between dining and living room and rounded walls in one end of the latter are details which add style and picturesqueness to the interior. The kitchen is planned for efficiency and step saving. The front bedroom on the second floor opens onto a balcony with iron rail. A door in the rear of the attached garage opens directly into the kitchen. There's a wall opening in the front of the garage for fuel passage to a storage bin.

The roof is of red tile or may be thick-butted asbestos shingles. An inclosing wall, capped with red tile, gives your yard privacy and retains the spirit of the style.

Popular Mechanics Magazine will supply readers a one-sheet blueprint of any house appearing in the magazine for $1, and a new bungalow book will be sent for ten cents.